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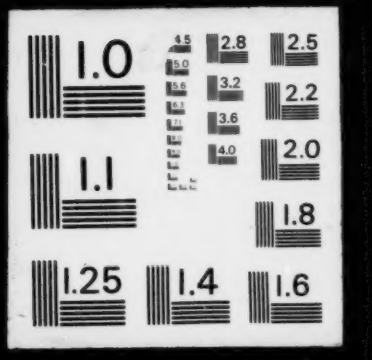

U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PB-260 007

AIR POLLUTION IN THE BIRMINGHAM, ALABAMA, AREA

ROBERT A. TAFT SANITARY ENGINEERING CENTER
CINCINNATI, OHIO

MAY 1958

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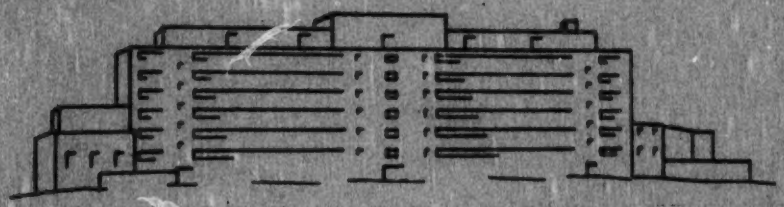

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U.S. DEPARTMENT OF HEALTH,
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Public Health Service

1958

AIR POLLUTION IN THE BIRMINGHAM, ALABAMA, AREA

Donald M. Keagy, Sanitary Engineer

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Air Pollution Engineering Program
State and Community Services

Prepared at the request of the Jefferson County, Alabama Department of Health and the City of Birmingham, Alabama (Department of Public Improvements).

U. S. Department of Health, Education, and Welfare
Public Health Service
Bureau of State Services
Division of Sanitary Engineering Services

Robert A. Taft Sanitary Engineering Center
Cincinnati, Ohio

May, 1958

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SUMMARY

At the request of local officials, a survey of the air pollution situation in Birmingham and Jefferson County, Alabama, was made by the Community Air Pollution Program of the Public Health Service. The scope of the survey was limited to collection and review of existing pertinent data, interviews with local officials, and the personal observations of two investigators. This report is the result of a detailed analysis of the data and information assembled relative to the factors affecting air pollution levels, sources of pollution, indications of pollution levels and control activity.

The population of the Birmingham area and of Jefferson County as a whole has increased about 30 per cent since 1940. This trend is expected to continue and is a factor favoring higher future pollution levels because of the accompanying increase in pollutant emissions.

The major portion of the greater Birmingham area is in Jones Valley wherein the winds are variable, both in direction and velocity, and the pollution sources are dispersed throughout the area. Therefore, all locations in the valley are exposed to the effects of air pollution. This mountain-valley type of topography, coupled with weak air drainage and temperature inversions, are favorable to the accumulation of pollution emissions that result from the use of fuel, industrial activity, and the incineration of wastes.

Local land use planning, whereby there is simply a reasonable separation of major pollution sources from "clean" land uses, will not materially reduce the effects of air pollution, except for fallout of heavy particulates. However, some good can be accomplished by area-wide land use

planning, whereby the heavy industry of one municipality will not be permitted to exist adjacent to residential sites of another community.

Burning of coal, gasoline, fuel gas, and fuel oil is a major source of air pollution. In recent years, there has been a rapid decrease in the use of coal as a fuel for space heating, cooking, and railroad locomotives. However, its use in the production of power and of coke for steel manufacturing is increasing.

The number of motor vehicles registered in Jefferson County has increased 95,000 (125 per cent) since 1940 and gasoline usage has increased 44 million gallons per year (37 per cent) in the past five years. This follows a national trend of more autos per thousand population and more miles driven per auto per year.

The Birmingham area is a manufacturing center and has many sources of industrial emissions. The heavy metals industry, particularly the steel industry, is undoubtedly the major source of industrial pollution.

Air pollution in Birmingham has a significant effect on visibility, which has been measured, and which can be observed on those days when the atmosphere is unable to disperse the pollutants effectively. Difficulty in growing certain plants and damage to foliage were reported by local nurserymen who believed that pollution emissions are responsible. The damaging effects of atmospheric pollutants on clothing, surface coatings, and construction materials were not measured specifically in this study, but on the basis of present knowledge and of the conditions noted, it is reasonable to assume that they exist in the Birmingham area.

The burning of refuse produces a relatively minor emission to the atmosphere in relation to other sources. Most domestic and commercial refuse is disposed of in sanitary landfills or municipal incinerators. Back-yard burning is not a common practice and few open burning dumps are to be found.

Summary

Specific air pollution control activity in the Jefferson County area is limited to the city of Birmingham. The City has one man attempting to abate local smoke nuisances under the provisions of a smoke ordinance which is inadequate to cope with the problem.

It can be concluded that there is substantial air pollution in the greater Birmingham area. A county-wide air pollution control program, more effective legislation, adequate personnel and facilities are recommended.

RECOMMENDATIONS

1. Efforts to control air pollution in the Birmingham area should be considerably expanded.

2. The present smoke control ordinance for Birmingham should be supplanted by up-to-date air pollution control legislation or rules and regulations for the entire County, including State enabling legislation as required.

3. A County-wide program of study, surveillance, prevention, and control of air pollution should be developed and should include:

    a. An inventory of air pollution sources and emissions.

    b. An air pollution meteorological study.

    c. Sampling of the ambient air for particulate and gaseous pollutants to the extent necessary to determine trends, law violations, and control needs.

    d. Laboratory services for sample analyses and limited investigative activities.

    e. Measures which will make it possible to insure that future alterations of and installations of fuel burning, refuse disposal, and manufacturing process equipment or facilities will not create air pollution problems.

    f. Program-initiated determination of violations of the rules and regulations followed by suitable abatement action.

    g. Abatement of the causes of justified public complaints.

h. Surveillance and study of the effects of air pollution on health, plant and animal life, and materials.

i. Dissemination of information to the general public pertaining to causes, effects, and methods of control of air pollution and concerning control efforts in the Birmingham area.

j. Support of other agencies or individuals whose work will enhance efforts to improve the air quality over the area.

4. An experienced air pollution control engineer should be appointed to administer the program. He should be provided with a chemist, a chief inspector, and such assistants and aides as are needed.

5. Funds should be allocated to carry out the program outlined herein. It is estimated that the cost would be $75,000 per annum.

6. Efforts should be made to unify or coordinate land use planning activities within the County so that the greatest possible amelioration of air pollution problems which can be achieved by such means is realized.

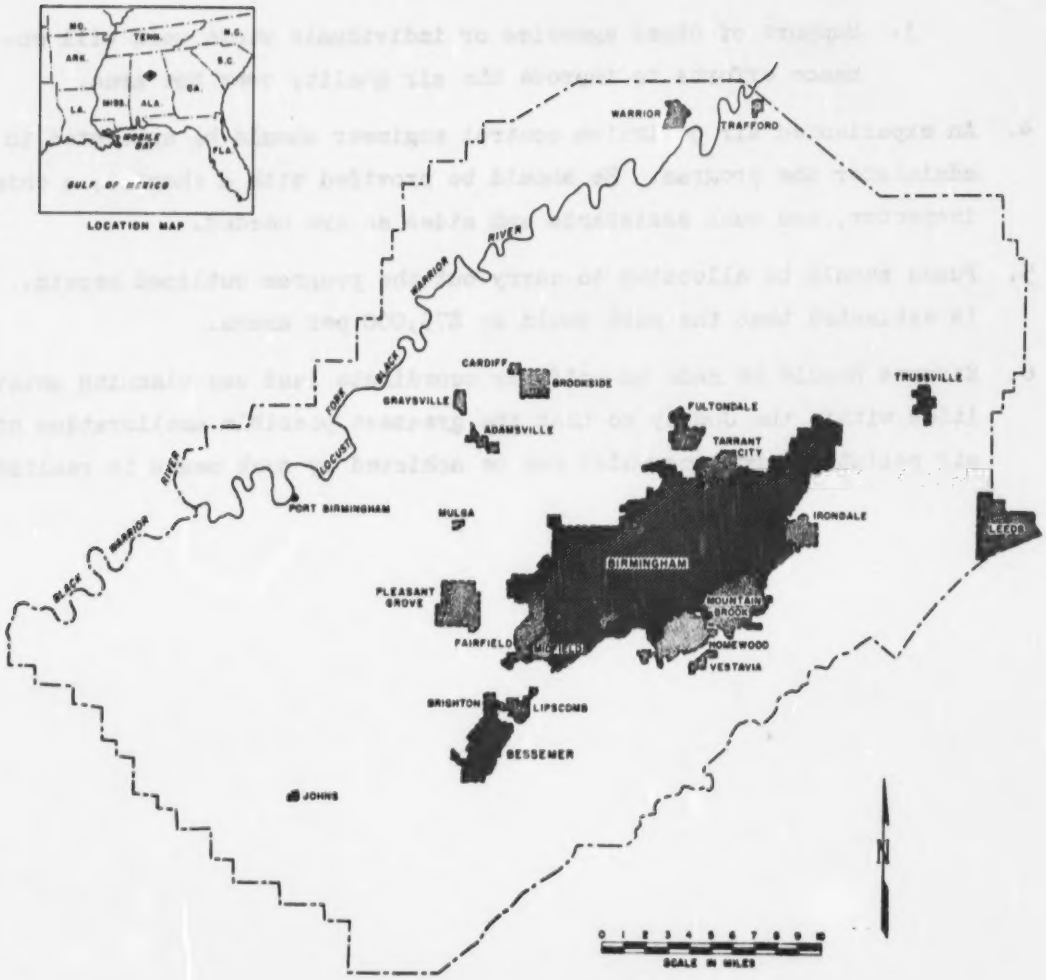

FIGURE 1. JEFFERSON COUNTY, ALABAMA, AND INCORPORATED PLACES

INTRODUCTION

BACKGROUND

Jefferson County is situated in the north-central portion of the State of Alabama (Figure 1) on the southern extension of the Appalachian Mountain system. It is in the center of the rich iron, coal, and limestone belt of the South. Although the county contains a little over two per cent of the State's land area, it embraces about one-sixth of the State's population and almost one-third of the total assessed property valuation.

The growth of Birmingham and Jefferson County is largely related to coal and iron. The bed of Jones Valley is limestone, the northern flank is coal, and the southern flank is iron ore. Nowhere else in the world do these three principal materials for making iron and steel exist together in such large quantities as they do here. During an average year, seventeen million tons of iron ore are taken from the billions of reserve tonnage.

At the start of the War between the States (1861) there were six or seven blast furnaces in Alabama, and their daily capacity was not more than 40 tons. Thirteen new furnaces were built during the War, and Alabama delivered more iron to the Confederacy than the rest of the Southern States combined.

Between 1878 (when the Pratt Coal and Coke Company was organized) and 1897, millions of dollars were invested in Jones Valley in opening mines, building ovens and rolling mills, and developing industries and communities. In 1897, the first cast of steel was made and the success of the pig-iron industries was assured.[1/]

In 1945, governmental officials of Birmingham recognized the existence of a local air pollution problem when they approved an ordinance prohibiting the emission of "dense" smoke. A smoke inspector was appointed to enforce the provisions of the ordinance.

In 1957, the Director of the Jefferson County Department of Health and the Birmingham Commissioner of Public Improvements recognized the potential problem which air pollution posed and the need for an improved and expanded air pollution control program of the area. They then requested the Public Health Service for technical assistance in conducting a survey which would evaluate the existing and potential air pollution problems of the area (Appendix A).

PURPOSE AND SCOPE

The purposes of this survey were to:

1. Review the existing and potential air pollution situations.
2. Review existing air pollution control activities.
3. Develop recommendations for organization, staff, facilities, program, and legislation relative to air pollution control activities.

The scope of the study was limited to consideration of available information relative to air pollution including: types of activity which cause pollution, evidences of pollution levels, meteorological and topographical influences on the dispersion of pollutants, existing or authorized governmental activity for control of air pollution, and other relevant community characteristics. The study area was the boundary of Jefferson County.

CONDUCT OF THE SURVEY

Two engineers from the Community Air Pollution Program, Robert A. Taft Sanitary Engineering Center, U. S. Public Health Service, spent

July 15-19, 1957 in the Birmingham Metropolitan Area. They received valuable assistance from Mr. Paul Pate, Jefferson County Health Department, who not only assembled certain information prior to the survey, but also spent considerable time with the investigators assisting in the collection of information. Mr. A. G. Manasco, Chief Smoke Abatement Inspector, City of Birmingham, also accompanied the investigators and assisted in collecting certain data. The bulk of the data was obtained through examination of existing recorded information, inspection trips, and through interviews with persons associated with many official and unofficial organizations.

The assistance so freely given by the Director of the Jefferson County Department of Health and the Commissioner of Public Improvements of Birmingham and their staffs is gratefully acknowledged. The cooperation and contributions of the following agencies are similarly acknowledged:

County:
- Department of Revenue
- Personnel Board
- Engineer's Office
- Planning Office
- Building Commissioner's Office
- Board of Commissioners

Administrative officials for the cities of:
- Bessemer
- Fairfield
- Homewood
- Mountain Brook
- Tarrant

Birmingham:
- City Planning Commission
- City Attorney's Office
- Housing Authority

and:

Southern Research Institute
Alabama Mining Institute
U.S. Weather Bureau, Municipal Airport
City Transit Company
Chamber of Commerce
Committee of 100
Birmingham News

GENERAL FACTORS AFFECTING AIR POLLUTION LEVELS

Community air pollution levels result principally from (1) the type and rate of discharge of pollutants to the atmosphere, and (2) the ability of the atmosphere to disperse these pollutants.

The rate of discharge is a function of, among other factors, population, the general character of industry and employment, and of land use. The interractions which take place are not completely known as yet, but the presence of sunlight is considered to be an important factor. The dispersive power of the atmosphere is a function of wind speed and direction, and the vertical distribution of temperature. Topographical features affect all three of these meteorological factors.

POPULATION

The population of the city of Birmingham and other areas of Jefferson County has increased steadily in recent years. The percentage of the total county population resident in Birmingham has remained approximately 60 per cent since 1920, but the percentage of the county which is incorporated has been increasing steadily (Table 1 and Figure 2). This means that Birmingham is growing in population at approximately the same rate as the county, but the other incorporated areas are growing at a more rapid rate. However, most of the incorporated areas in the county having large numerical increases in population are located close to Birmingham. It appears that these trends will continue.

Table 1. POPULATION, JEFFERSON COUNTY AND INCORPORATED PLACES[2/]

Area	1920	1930	1940	1950	1956
Incorporated areas	212,593	313,886	331,270	416,505	----
Bessemer	18,674	20,721	22,826	28,445	31,956
Birmingham	178,806	259,678	267,583	326,037	356,318
Brighton	3,665	1,708	1,377	1,689	2,860
Brookside	666	466	714	733	*
Cardiff	463	146	246	204	*
Fairfield	5,003	11,059	11,703	13,177	14,186
Fultondale	----	----	----	1,304	1,668
Graysville	----	----	605	879	2,590
Homewood	----	6,103	7,397	12,866	18,830
Irondale	809	1,517	1,486	1,876	2,800
Leeds	1,600	2,529	2,910	3,306	5,553
Lipscomb	1,605	1,774	1,740	2,550	*
Midfield	----	----	----	----	3,362
Mountain Brook	----	----	3,372	8,359	10,937
Mulga	----	----	----	532	*
Mulga Mine	----	----	----	1,211	*
North Johns	----	344	404	454	*
Pleasant Grove	----	----	1,066	1,802	2,212
Tarrant City	734	7,341	6,833	7,571	8,035
Trafford	----	----	----	551	*
Trussville	----	----	----	1,575	*
Warrior	568	646	1,008	1,384	*
Unincorporated areas:	97,461	117,607	128,660	142,415	
Jefferson County:	310,054	431,493	459,930	558,920	620,802

Population percentage relationships

% of county population in incorporated areas	69%	73%	72%	75%	----
% of incorporated area population in Birmingham	84%	86%	81%	79%	----
% of county population in Birmingham	58%	60%	58%	59%	----

* No official population information available.

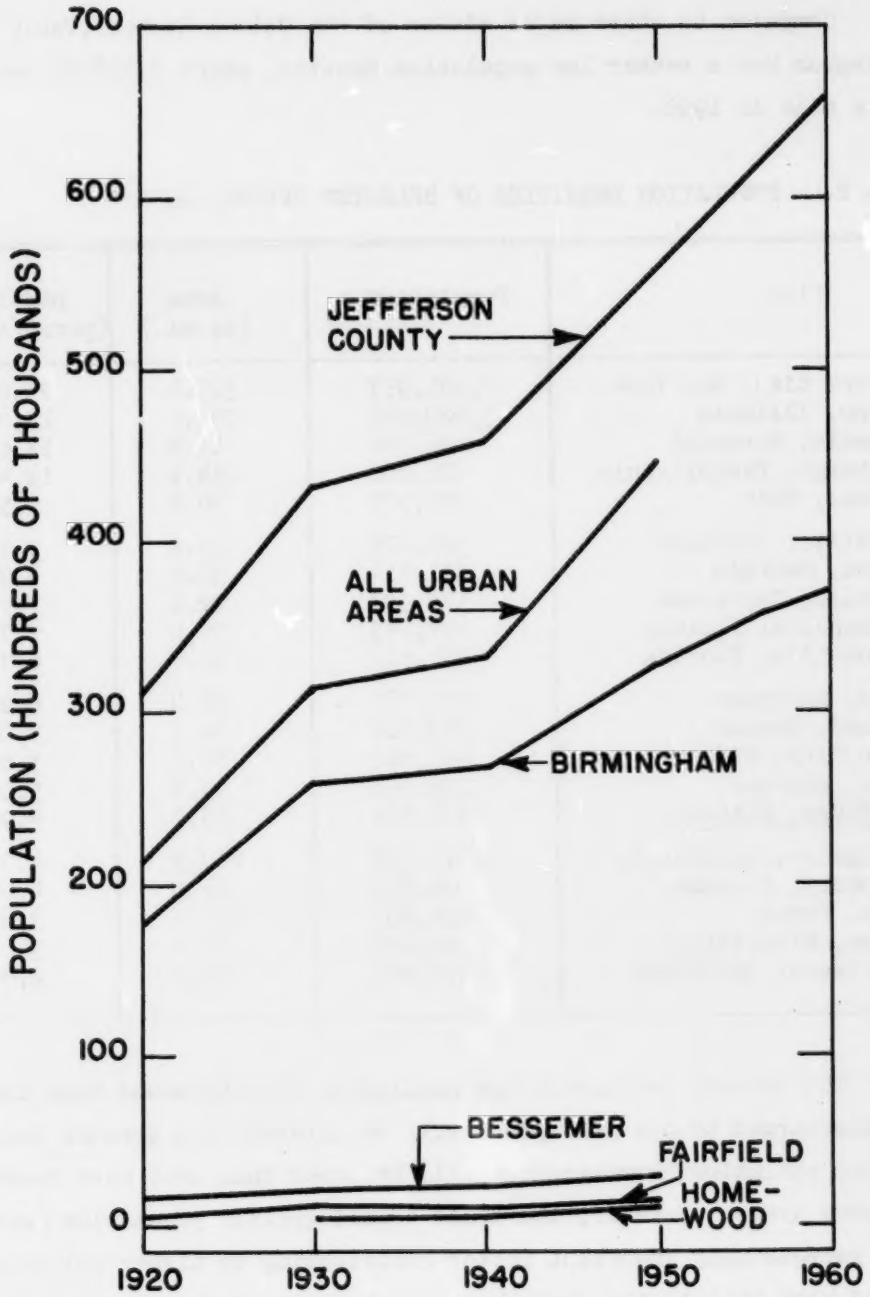

FIGURE 2. POPULATION GROWTH OF JEFFERSON COUNTY AND CERTAIN INCORPORATED PLACES

Compared to other major cities of the United States (Table 2), Birmingham has a rather low population density, about 5,318 persons per square mile in 1956.

Table 2. POPULATION DENSITIES OF SELECTED CITIES, 1950[3/]

City	Population	Area (sq.mi.)	Density (pers./sq.mi.)
New York City, New York	7,891,957	315.1	25,046
Chicago, Illinois	3,620,962	207.5	17,450
St. Louis, Missouri	856,796	61.0	14,046
Pittsburgh, Pennsylvania	676,806	54.2	12,487
Columbus, Ohio	375,901	39.4	9,541
Louisville, Kentucky	369,129	39.9	9,251
Atlanta, Georgia	331,314	36.9	8,979
Nashville, Tennessee	174,307	22.0	7,923
Indianapolis, Indiana	427,173	55.2	7,739
Jacksonville, Florida	204,517	30.2	6,772
Denver, Colorado	415,786	66.8	6,224
Portland, Oregon	373,628	64.1	5,829
Kansas City, Missouri	456,622	80.6	5,665
Mobile, Alabama	129,009	25.4	5,079
BIRMINGHAM, ALABAMA	326,037	65.3	4,993
Los Angeles, California	1,970,358	450.9	4,370
Montgomery, Alabama	106,525	26.1	4,081
Dallas, Texas	434,462	112.0	3,879
Jackson, Mississippi	98,271	27.0	3,640
New Orleans, Louisiana	570,445	199.4	2,861

The present relatively low population density means that the pollution discharged to the atmosphere will be diluted to a greater degree and thus the pollution concentration will be lower than over more densely populated areas. However, the trend toward greater population density will be an increasingly important factor contributing to higher pollution levels. Coupled with this is the fact that, as the individual urbanized areas

increase in size, their pollution effects on neighboring cities or areas also increase. This points to the need in air pollution control work for close coordination of all air pollution control activities in a metropolitan area.

GENERAL CHARACTER OF INDUSTRY AND EMPLOYMENT

Because of the wealth of such natural resources as coal, iron ore, limestone, clay, stone, graphite, bauxite, gravel, silica, quartz, and pyrite, Birmingham has become one of the major industrial centers of the South. Millions of tons of steel ingots and finished steel products are manufactured each year, as well as an enormous pig-iron tonnage, and 60 per cent of the Nation's entire supply of cast-iron pipe.

This manufacturing city also produces such diverse things as cookies, chinchillas, mattresses, meat, aircraft, aluminum, steel tanks, industrial safety equipment, chains, bus and truck equipment, chemicals, bottle caps, rubber goods, asphalt, fuel oils, car wheels, furniture, envelopes, and machine tools.

Birmingham's unusually large labor territory embraces ten counties and 7,000 square miles which have an estimated population of more than 1,000,000 and a labor force estimated at slightly less than 400,000 (Table 3).

Table 3. BIRMINGHAM LABOR MARKET, 1956[2/]

County	Population	Labor force (est.)
Jefferson	620,800	257,400
Blount	28,750	9,000
Shelby	30,650	8,000
St. Clair	25,500	8,200
Bibb	16,900	5,500
Tuscaloosa	105,750	36,080
Walker	62,500	16,700
Cullman	50,000	17,000
Tallodega	70,000	25,595
Chilton	26,100	8,700
Total	1,036,950	392,175

Since 1940 Jefferson County has been classified by the U.S. Department of Labor as Class "C" (moderate surplus), there being three to six per cent unemployed during this period. The total employed has been steadily increasing, and in 1956, it was distributed as shown in Tables 4 and 5. It has climbed from about 202,000

Table 4. EMPLOYMENT, JEFFERSON COUNTY, DECEMBER 1956[2/]

Employment group	No. of persons*
GENERAL DATA	
Total civilian labor force:	257,400
Unemployed	9,050
Involved in labor dispute	700
Employed:	247,650
Agriculture	3,500
Non-agricultural:	244,150
Self-employed and domestic service workers	34,400
Wage and salary workers	209,750
NON-AGRICULTURAL EMPLOYMENT DATA	
All manufacturing:	68,950
Durable goods:	55,800
Lumber and basic wood products (except furniture)	1,650
Furniture and fixtures	750
Stone, clay and glass products	3,400
Primary metal industries:	29,850
Blast furnaces and steel works	21,400
Iron and steel foundries	7,900
Fabricated metal products	6,350
Machinery (except electrical)	2,050
Transportation equipment	10,050
Other durable goods	1,700
Non-durable goods:	13,150
Food and kindred products	4,600
Apparel and similar products	1,250
Printing, publishing and allied products	2,350
Chemicals and allied products	1,800
Products of petroleum and coal	2,050
Other non-durable goods	1,100
All non-manufacturing:	140,800
Transportation, communication and utilities	16,800
Trade:	48,400
Wholesale	16,100
Retail	32,300
Finance, insurance and real estate	12,000
Service (except domestic)	21,850
Government	18,700
Construction (contract)	13,350
Mining and quarrying:	9,700
Metal mining	2,500
Bituminous coal mining	6,650

* Rounded to nearest 50.

in 1950 to about 248,000 in 1956 -- an increase of nearly 14 per cent. It appears then, that there is an ample labor supply for continued industrial expansion.

Table 5. DISTRIBUTION OF EMPLOYMENT, JEFFERSON COUNTY, 1956

Employment group	Percent of total labor force*
Trade (wholesale and retail)	19.5
Self-employed and domestic service	13.9
Primary metal industries	12.0
Service (except domestic)	8.8
Government	7.5
Transportation, communication and utilities	6.8
Construction	5.4
Finance, insurance and real estate	4.8
Transportation equipment manufacturing	4.0
Mining and quarrying	3.9
Fabricated metal products manufacturing	2.6
Food and kindred products manufacturing	1.8
(All others)	9.0
	100.0

* Computed from data presented in Table 4.

In 1950, an average of 26.0 per cent of the labor force was employed in manufacturing. This compares closely with the average of 25.6 per cent for other standard metropolitan areas of approximately the same population (Table 6). In 1956, the ten largest employers in the county employed almost 70 per cent of all manufacturing workers (Table 7). Approximately half of the manufacturing employees are engaged by industries which usually are expected to discharge quantities of air pollutants.

Table 6. COMPARISON OF EMPLOYMENT IN ALL STANDARD METROPOLITAN AREAS OF 500,000 TO 750,000 POPULATION IN U.S., 1950[3]

Area	Population	Total employed	Manufacturing	% Employed in mfg.
United States	150,697,361	56,239,449	14,575,703	25.9
METROPOLITAN AREAS (500,000-750,000 pop.)				
Youngstown,O.	528,498	202,318	98,948	48.9
Providence,R.I.	737,203	293,011	137,155	46.8
Indianapolis,Ind.	551,777	233,959	76,958	32.9
Alb.,Schenectady,Troy,N.Y.	514,490	208,383	68,211	32.7
Louisville,Ky.	576,900	224,444	69,188	30.8
BIRMINGHAM,ALA.	558,928	201,512	52,480	26.0
Columbus,O.	503,410	199,977	50,045	25.0
Seattle,Wash.	732,992	281,827	57,403	20.4
Portland,Ore.	704,829	273,348	54,443	19.9
Atlanta,Ga.	671,797	272,552	52,983	19.4
Dallas,Tex.	614,799	268,092	49,951	18.6
Denver,Col.	563,832	217,998	36,164	16.6
New Orleans,La.	685,405	254,838	39,895	15.7
San Diego,Calif.	556,808	168,830	23,905	14.2
San Antonio,Tex.	500,460	159,966	18,302	11.4
Totals	9,002,128	3,461,055	886,031	25.6

Table 7. TEN LARGEST EMPLOYERS IN JEFFERSON COUNTY, 1956[4]

Employer	Employees
1. Tennessee Coal and Iron Division, United States Steel Corporation	25,000
2. Hayes Aircraft Corporation	7,750
3. U.S. Pipe and Foundry	3,850
4. Woodward Iron Company	2,600
5. American Cast Iron Pipe Company	2,400
6. Pullman Standard Car Manufacturing Company	1,750
7. Republic Steel Corporation	1,550
8. Stockham Valves and Fittings	1,250
9. Continental Gin Company	1,000
10. Alabama By-Products Company	750
Total	47,900

Table 8. NUMBER OF FIRMS AND EMPLOYMENT IN MANUFACTURING BY MAJOR INDUSTRY GROUPS, JEFFERSON COUNTY, IN 1947[2], 1954[2], AND 1956[2]

Industry	No. of establishments 1954	Total employment*			% of mfg. employment		
		1947	1954	1956	1947	1954	1956
Food and related products except dairy products	97	4,109	4,273	4,600	7.7	7.4	6.7
Apparel & related products	19	885	1,051	1,250	1.7	1.8	1.8
Lumber & wood products	66	1,636	1,466	1,650	3.1	2.5	2.4
Printing & publishing	73	1,890	1,990	2,350**	3.5	3.4	3.4**
Pulp, paper & products	4	355	572				
Furniture & fixtures	31	765	653	750	1.4	1.1	1.1
Chemicals & products	37	1,215	1,193	1,800	2.3	2.1	2.6
Petroleum & coal products	10	2,044	2,451	2,050	3.8	4.2	3.0
Stone, clay, & glass products	48	3,177	2,952	3,400	6.0	5.1	4.9
Primary metal industries	45	23,857	22,284	29,850	44.7	38.6	43.3
Fabricated metal products	80	5,240	5,737	6,350	9.8	9.9	9.2
Machinery except electrical	46	4,237	3,104	2,050	7.9	5.4	3.0
Electrical machinery	9	407	705	----	0.8	1.2	---
Transportation equipment	12	1,658	7,158	50	3.1	12.4	14.6
Miscellaneous manufacturers	28	1,884	2,173	2,800	3.5	3.8	4.1
All industries, totals	605	53,359	57,762	68,950	100.0	99.9	100.1

* 1956 figures are for December 1956. 1954 figures are average of the midmonth employment for March, May, August and November. 1947 figures are average of the midmonth employment for all 12 months of the year.

** In 1956 the data for "Pulp, paper and products" and "Printing and publishing" were combined.

The statistics for 1947, 1954, and 1956 (Table 8) show that the only significant changes in the occupational pattern were: the percentage of persons employed in transportation equipment industries has been climbing rapidly; the percentage of employment in machinery industries (except electrical) has been declining slowly; and the percentage employed in the primary metals industries has returned to the 1947 level after a slight dip. These changes are not particularly significant from the air pollution standpoint.

As industry has grown in Jefferson County, it has developed at a more rapid rate within the city limits of Birmingham than it has in the remainder of the county (Table 9 and Figure 3). The increase in numbers employed has been accompanied by a similar increase in the number of manufacturing establishments. The average number of employees per plant and the distribution of small, medium, and large plants has remained approximately the same (Table 10).

Table 9. COMPARISON OF MANUFACTURING EMPLOYMENT, CITY OF BIRMINGHAM AND JEFFERSON COUNTY, ALABAMA, 1935, 1947, 1950, AND 1954

Geographic area	Manufacturing employment							
	1935[6]		1947[3]		1950[3]		1954[7]	
	Number	%	Number	%	Number	%	Number	%
Jefferson County	22,471	100	53,295	100	52,480	100	57,762	100
Birmingham	10,528	47	26,484	50	31,956	61	37,252	64
Jefferson County (excluding B'ham)	11,943	53	26,811	50	20,524	39	20,510	36

Therefore, along with the steady population growth, there is continued industrial expansion and a corresponding increase in employment. All other factors being equal, this would mean that there is undoubtedly a steadily increasing amount of pollutants being discharged into the atmosphere. Since the character of industry is not changing appreciably, the

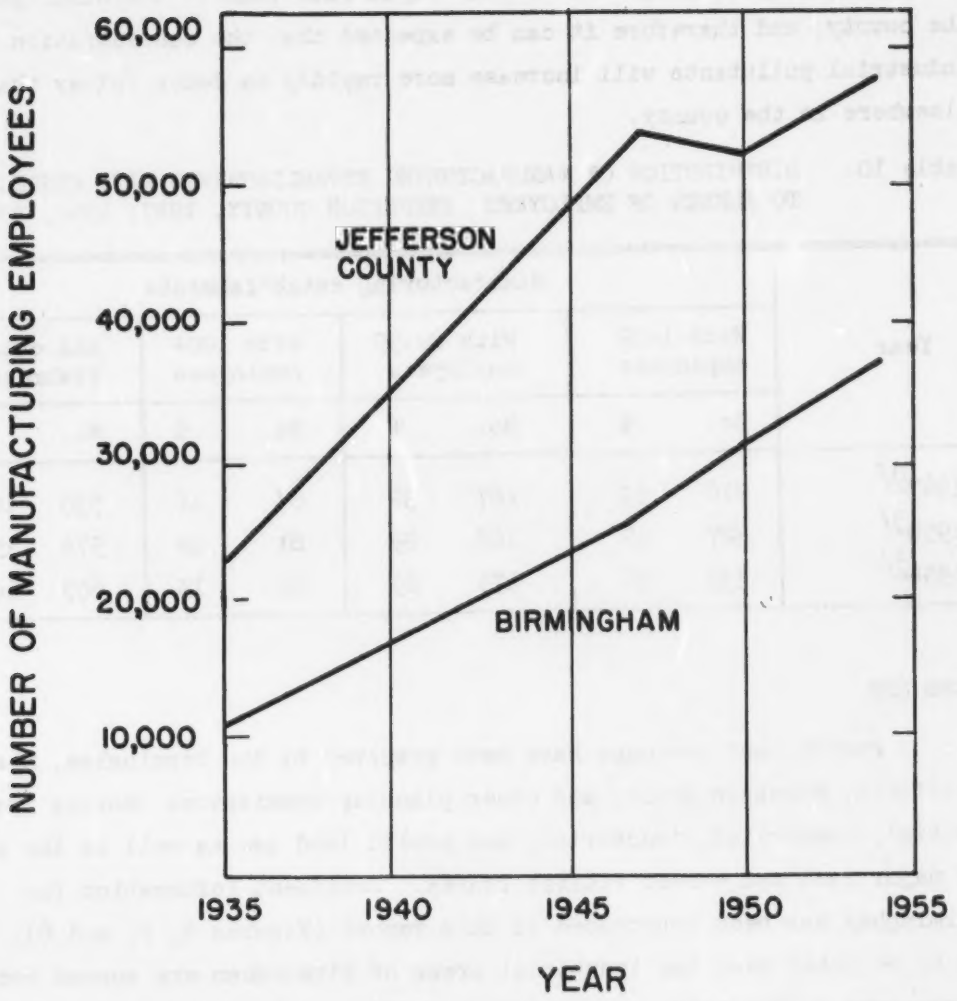

FIGURE 3. EMPLOYEES IN MANUFACTURING, JEFFERSON COUNTY, ALABAMA

character of the pollution will be about the same. But the industries are locating in Birmingham at a more rapid rate than in the other parts of the county, and therefore it can be expected that the concentration of industrial pollutants will increase more rapidly in Jones Valley than elsewhere in the county.

Table 10. DISTRIBUTION OF MANUFACTURING ESTABLISHMENTS WITH RESPECT TO NUMBER OF EMPLOYEES, JEFFERSON COUNTY, 1947, 1950, AND 1954

Year	Manufacturing establishments							
	With 1-19 employees		With 20-99 employees		With 100+ employees		All establishments	
	No.	%	No.	%	No.	%	No.	%
1947[8/]	276	52	167	32	87	16	530	100
1950[3/]	327	57	168	29	81	14	576	100
1954[5/]	339	56	175	29	91	15	605	100

LAND USE

Future land use maps have been prepared by the Birmingham, Bessemer, Fairfield, Mountain Brook, and other planning commissions showing residential, commercial, industrial, and public land use as well as the pattern of major rail and street traffic routes. Pertinent information for Birmingham has been reproduced in this report (Figures 4, 5, and 6). It is to be noted that the industrial areas of Birmingham are spread over a large area of the city. A comparison of Figures 4 and 5 discloses the intermixing of industrial and residential uses. Areas designated for future industrial land use are approximately the same as existing ones.

This intermixing of land use in Jones Valley plus the variable wind directions experienced, as will be shown in the next section, means that it will prove difficult to substantially reduce the adverse effects of air pollution through land use planning.

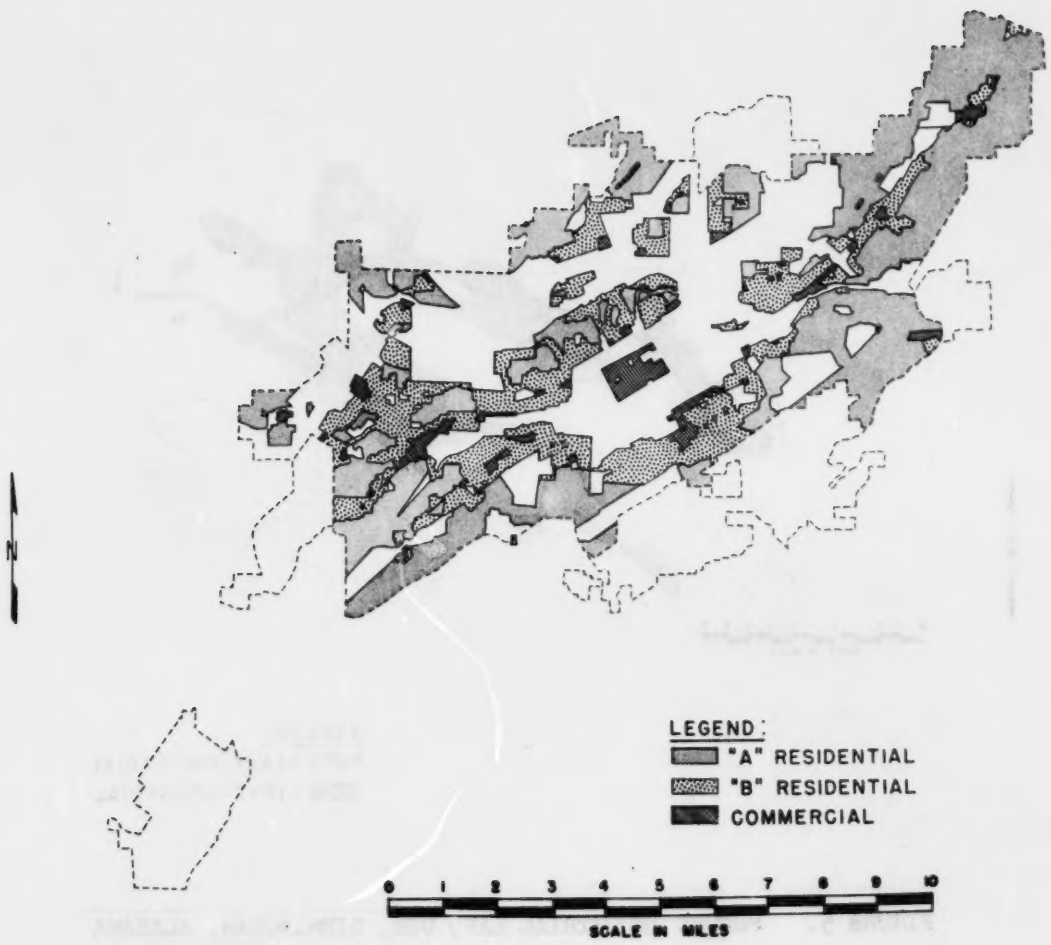

FIGURE 4. FUTURE RESIDENTIAL AND COMMERCIAL LAND USE, BIRMINGHAM, ALA.

FIGURE 5. FUTURE INDUSTRIAL LAND USE, BIRMINGHAM, ALABAMA

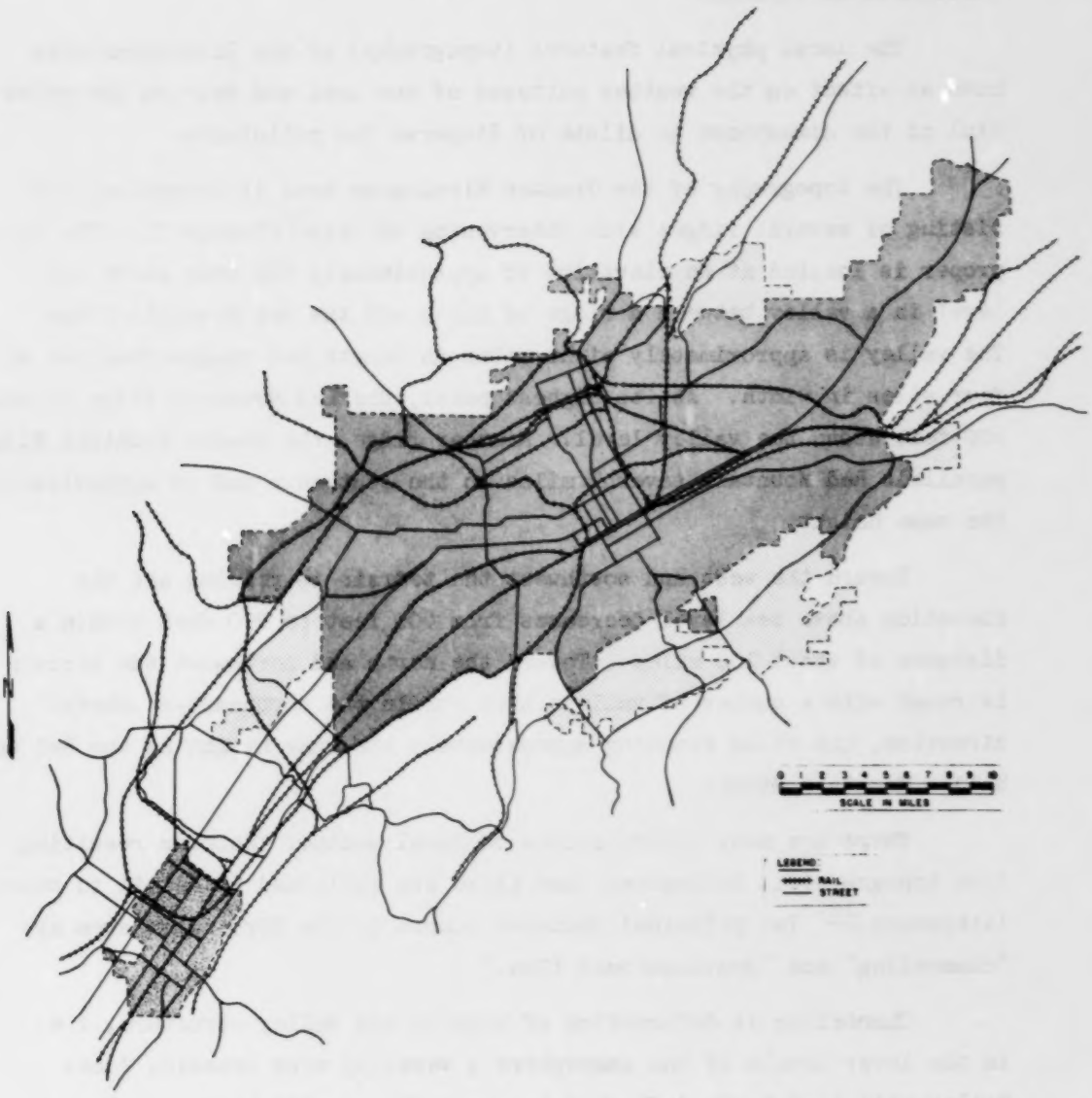

FIGURE 6. FUTURE RAIL AND STREET THOROUGHFARES, GREATER BIRMINGHAM AREA

TOPOGRAPHICAL FEATURES

The local physical features (topography) of the Birmingham area have an effect on the weather patterns of the area and thus on the potential of the atmosphere to dilute or disperse the pollutants.

The topography of the Greater Birmingham area is irregular, consisting of several ridges with intervening valleys[9] (Figure 7). The city proper is located at an elevation of approximately 600 feet above sea level in a valley between a ridge of hills and the Red Mountain Ridge. The valley is approximately eight miles in length and ranges from two to four miles in width. At its highest point, the Red Mountain Ridge is about 600 feet above the valley level. Another ridge, the Shades Mountain Ridge, parallels Red Mountain several miles to the southeast and is approximately the same height.

Toward the west and southwest the terrain is rolling and the elevation above sea level decreases from 600 feet to 200 feet within a distance of about 100 miles. Toward the north and northwest the terrain is rough with a number of valleys that run in the northeast-southwest direction, the hills reaching approximately the same height as the Red and Shades Mountain Ridges.

There are many ramifications of local weather features resulting from topographical influences, and these are explained in detail in other literature.[10] Two principal features common to the Birmingham area are "channeling" and "gravitational flow."

Channeling is deformation of wind by the valley structure, i.e., in the lower levels of the atmosphere a westerly wind crossing Jones Valley will tend to be deflected to the left and will be recorded as a southwesterly wind at the airport. The effect, from the standpoint of air pollution, is that pollutants tend to be confined to the valley. Under this condition, the valley areas will be exposed to pollutants a greater percentage of time than they would had the area been level.

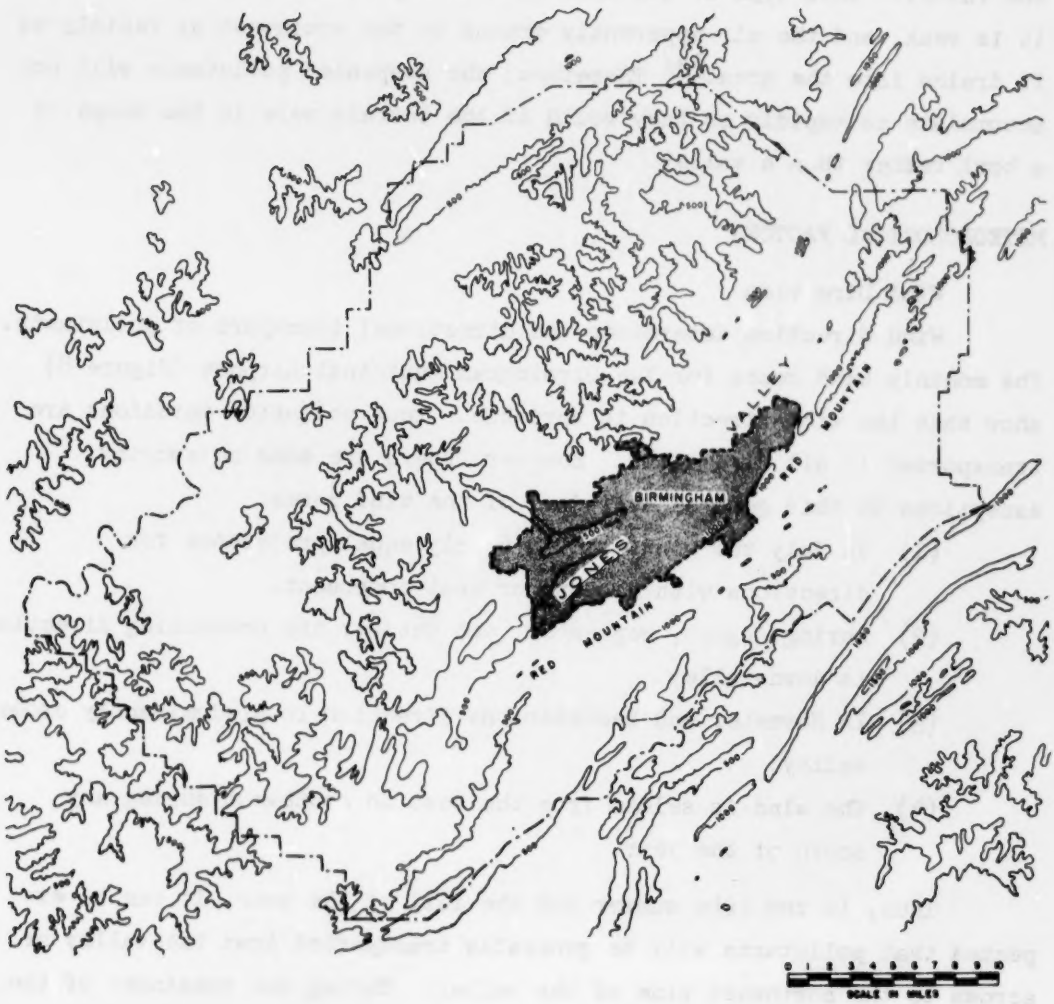

FIGURE 7. TOPOGRAPHY OF JEFFERSON COUNTY, ALABAMA

Gravitational flow is the flow of cooler heavier air down the slopes of a hill into the valley and usually occurs at night and in the early morning. In this process, pollutants emitted at higher elevations are carried to the lower levels and added to the pollutants emitted in the valley. This type of air drainage was reported for the Jones Valley but it is weak, and the air apparently drains to the southwest as rapidly as it drains into the area.[14] Therefore, the suspended pollutants will not accumulate as rapidly as they would if the terrain were in the shape of a bowl rather than a valley.

METEOROLOGICAL FACTORS

Wind Direction

Wind direction determines the directional transport of pollutants. The monthly wind roses for the Birmingham Municipal Airport (Figure 8) show that the wind direction is variable. Thus pollution emissions are transported in all directions. However, there are some noteworthy exceptions to this general appraisal of the wind roses:

(1) In July the winds show a nearly equal preference for directions with a south or east component.

(2) During August, September, and October the prevailing direction is down-valley.

(3) In November and December the direction is predominantly cross-valley.

(4) The wind is seldom from the west to southwest during any month of the year.

Thus, in the late summer and the fall of the year, it can be expected that pollutants will be generally transported down the valley or across to the northwest side of the valley. During the remainder of the year the direction of transport is quite variable.

Wind Speed

The amount of air available for diluting pollutants is directly

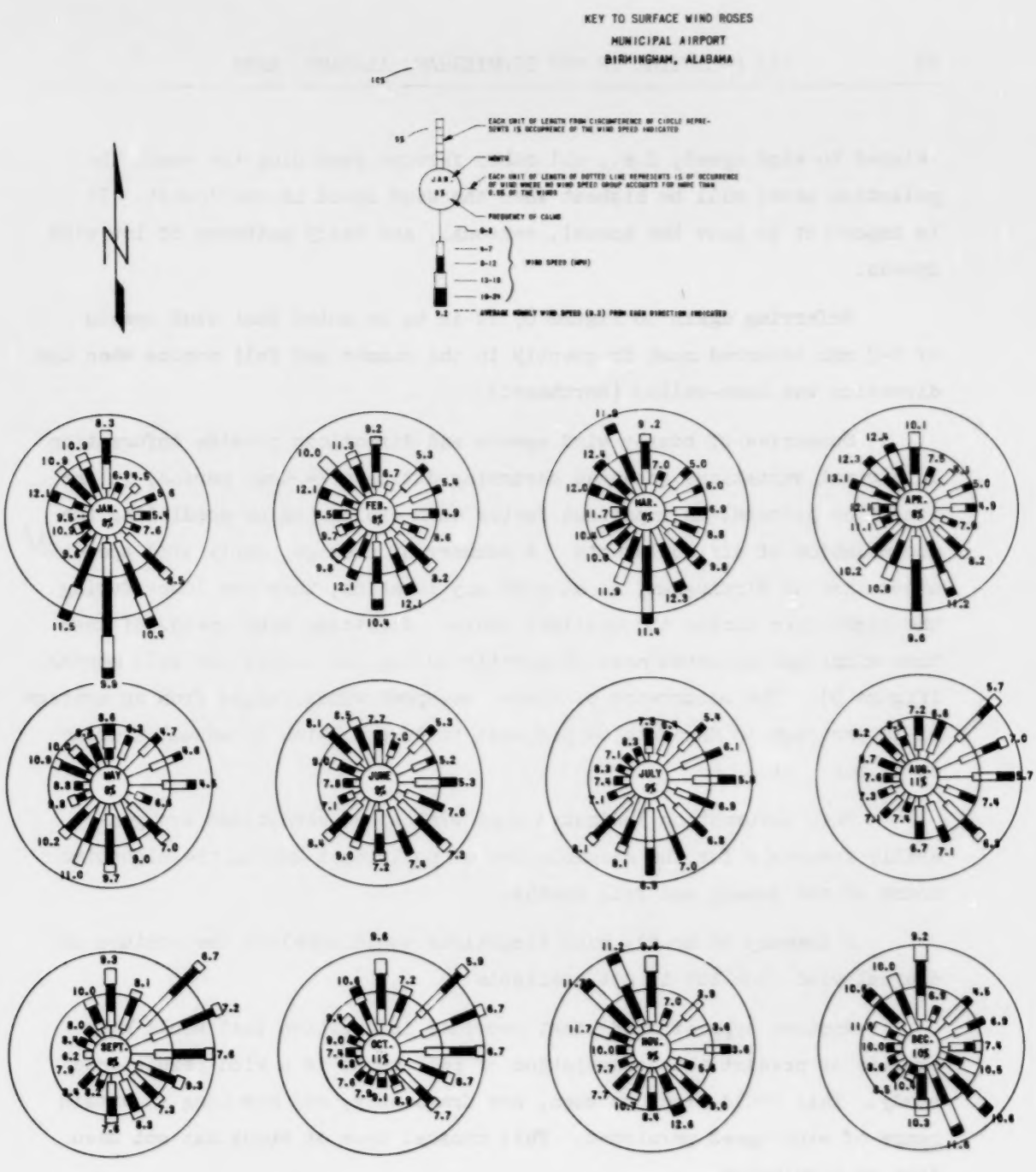

FIGURE 8. WIND ROSES PLOTTED FROM MONTHLY RECORDS (1949-1954) OF WEATHER STATION AT BIRMINGHAM MUNICIPAL AIRPORT

related to wind speed, i.e., all other factors remaining the same, the pollution level will be highest when the wind speed is the lowest. It is important to know the annual, seasonal, and daily patterns of low wind speeds.

Referring again to Figure 8, it is to be noted that wind speeds of 0-3 mph occurred most frequently in the summer and fall months when the direction was down-valley (Northeast).

Summaries of hourly wind speeds and directions provide information on diurnal variations (changes occurring during a 24-hour period) in the wind-flow pattern, an important factor when explaining or predicting the accumulation of air pollutants. A summary of average hourly wind speeds[11] shows that at Birmingham, as at most any location, they are lower during the night than during the daylight hours. Nighttime wind speeds of less than eight mph occurred most frequently during the summer and fall months (Figure 9). The occurrence of these low-speed winds ranged from an average of 38 per cent in March to 64 per cent in August, with an annual average of 51 per cent.

This information indicates that wind speed conditions are generally favorable for the accumulation of pollutants during the nighttime hours of the summer and fall months.

A summary of hourly wind directions would complete the picture of diurnal wind flow but is not available.

Another type of study that provides information that would help explain or predict the accumulation of pollutants is a wind persistence study. This would disclose when, how frequently, and how long a certain range of wind speed persisted. This unusual type of study has not been done at Birmingham.

Atmospheric Stability

Atmospheric stability is a characteristic of a layer or layers of the air which controls, in part, the vertical motion within the layers.

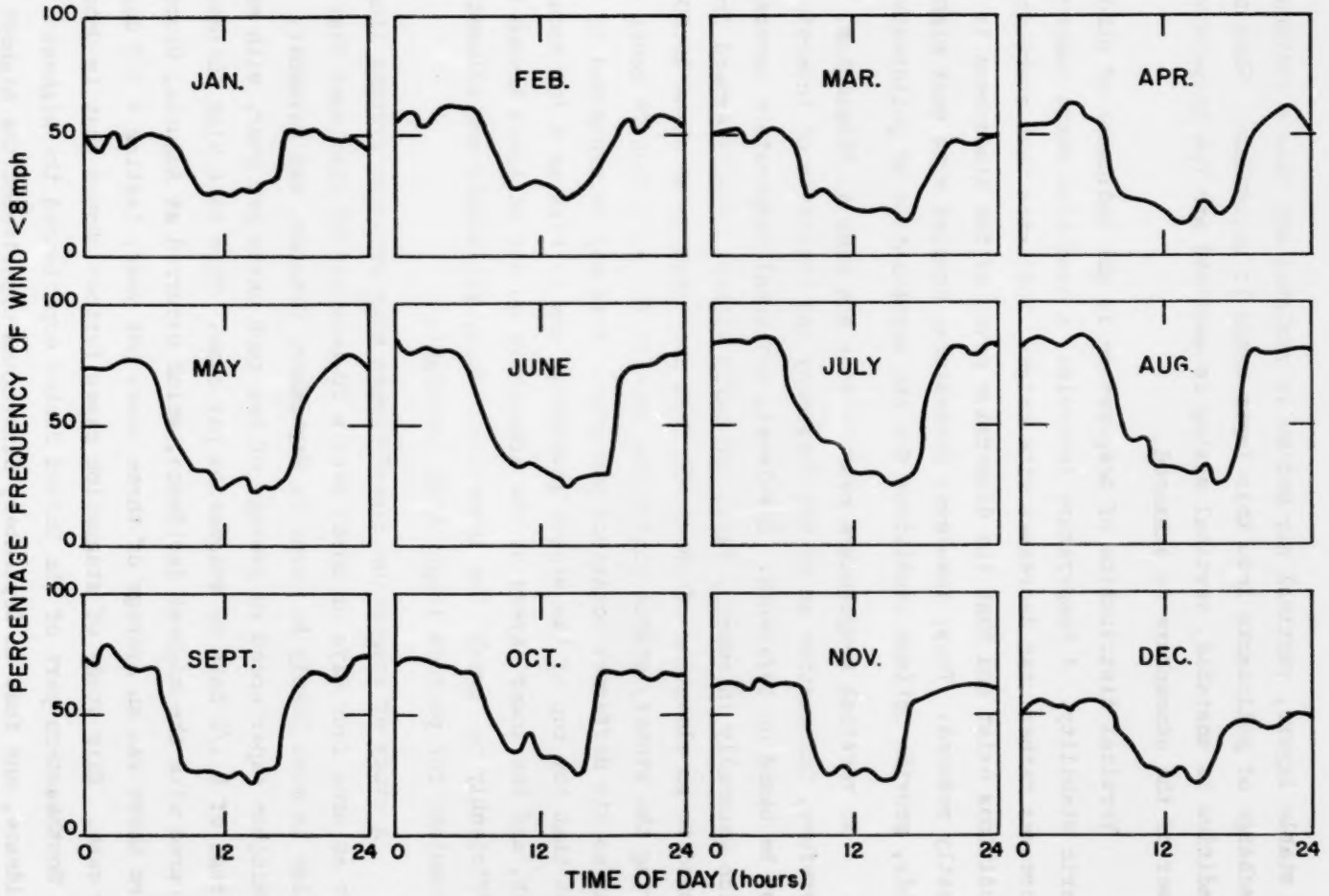

FIGURE 9. PERCENTAGE FREQUENCY OF HOURLY WIND SPEED LESS THAN 8 MPH FOR BIRMINGHAM, ALABAMA, MAY 1949 - MAY 1954.11/

In stable layers, vertical air motion is resisted and thus a continuing discharge of pollutants into this layer tends to accumulate. When the condition is unstable, vertical mixing is assisted and the dispersive power of the atmosphere is enhanced.

Vertical distribution of temperature is the indicator of atmospheric stability. A temperature inversion, a condition where temperature increases rather than decreases with height, indicates that stability conditions exist and that the dispersive power of the atmosphere is greatly reduced. Thus, low-level inversions, coupled with weak nighttime winds, provide optimum conditions for the accumulation of pollutants.

No vertical temperature measurements are made at Birmingham. Therefore, information as to the frequency and intensity of inversions must be based on inference. Low-level, nocturnal temperature inversions, which generally in summer, fall, and early winter, usually extend from the ground to an elevation of about 450 feet and break up at about 10:00 a.m.[12] During the winter, stable conditions persist for more than 24 hours on as many as six different occasions per year. This may be explained by the fact that the top of the winter inversions are as high as a few thousand feet, and the lower layers of the atmosphere do not at times become heated sufficiently to "break" the inversion. Thus, pollutants are allowed to accumulate for periods longer than overnight.

A study of stagnation cases[13] (when high pressure systems linger over an area four days or more) over a 20-year period disclosed that stagnation is most likely to occur in September, October, and November. Birmingham experienced an average of two such cases per year, with an average of 4 1/2 days of stagnation per case. This is a high incidence as compared with the highest incidence, which occurred at Augusta, Georgia, where there was an average of three cases per year, lasting 4 2/3 days per case. This study of stagnation cases further showed that in October, the Southeastern part of the United States experienced the highest incidence, and that in September, Birmingham experienced the highest

incidence of all stations in this area. During these periods of stagnation surface wind speeds may fall to very low values. Surface circulation is therefore insufficient to diffuse the accumulated pollutants, thereby causing distress and possibly hazardous conditions for the local inhabitants.

Other Meteorological Factors

Possible sunshine - At the Birmingham airport the monthly average of possible sunshine ranges from 44 per cent in December to 69 per cent in October. The amount of sunshine received in the lower levels of the atmosphere is considered an important factor in the study of air pollution. For instance, the hydrocarbons contained in auto exhaust have been shown to react with ozone, when in the presence of sunlight, to form an adverse smog condition. On the other hand, sunshine may diminish pollution levels because, when the sun's rays heat the ground, temperature inversions are minimized or destroyed and the circulation in the lower levels of the atmosphere is accelerated. Clouds, fog, and smoke reduce the amount of sunshine. High humidity is necessary for the formation of this fog and cloud cover and, at Birmingham, warm, moist southerly winds keep the average monthly relative humidity high throughout the year.

A special study[14] has been made which shows the adverse effect of smoke on ceiling and visibility at the Birmingham airport. As would be expected, the greatest effect was experienced during the heating season. Smoke reduced visibility below one mile on 25 days in an average winter season, and on a few occasions the visibility was below one mile at sunset and remained so until late the following morning. The study also showed that in 78 per cent of the cases adverse smoke conditions developed in the early morning, and in 14 per cent they formed in the early evening. It was noted that smoke conditions had a tendency to recur one night after another in a definite pattern until the regional meteorological conditions changed sufficiently to disperse the pollution. These conditions

caused a definite interruption in airline schedules and a reduction in the amount of sunshine.

Precipitation - Rain or snow acts to cleanse the lower levels of the atmosphere by a natural phenomenon called "wash-out", i.e., a part of the pollutants in the atmosphere are captured by the precipitation and carried to the ground.

The total precipitation at Birmingham averages nearly 54 inches per year. Summer precipitation is chiefly in the form of thunder showers. September and October are the months when the least "wash-out" can be expected.

It may be concluded that during the fall months meteorological conditions are favorable for the development of high pollution levels. During this period the wind speeds are low, stability and stagnation conditions occur most frequently, sunshine for photochemical activity is highest, and "wash-out" by precipitation is low.

SOURCES OF POLLUTION

FUEL USE

Coal

It has been estimated that 8,350,000 tons of bituminous coal were burned in the Birmingham district in 1956. Approximately 82 per cent was used for industrial purposes.[15]

There are four areas of bituminous coal deposits in Alabama which serve as sources of supply for Birmingham. They are, in order of importance: the Warrior, Cahaba, Plateau, and Coosa fields. Only the first two produce any great quantity. In general, Alabama coals are high in ash content. The average coal seam analysis for the Warrior field shows: 30% volatile matter, 61.2% fixed carbon, 6.4% ash, 0.8% sulfur, and 2.5% moisture.[16]

Coal has been the predominant fuel for domestic heating in the Birmingham urbanized area, but heating units are rapidly being converted to gas (Table 11). In 1940, over 90 per cent of both the central and non-central heating units burned coal. In 1950, these figures had dropped to around 50 per cent, and undoubtedly Birmingham has continued to follow the national trend to gas since 1950. In 1940, about half of the Birmingham families used coal for cooking purposes. In 1950, 30 per cent were still using this fuel (Table 11). Conversion to gas and electricity have accounted for the decrease.

Approximately one ton of coal is used for each ton of steel produced. The national picture in this industry in the decade 1946-1955 has been one of fluctuations, with the lowest point having been reached in 1954. The long-term trend appears to be toward more steel and thus more coal.[19]

Table 11. DOMESTIC FUEL USE IN THE BIRMINGHAM URBANIZED AREA, 1940 & 1950

Domestic fuel use	1940[17]	1950[18]	Change
HEATING USE			
Number of dwellings reporting heating equipment	104,435	123,785	+19,350
% heated with coal	95.2	54.4	-40.8
% heated with gas	2.1	38.8	+36.7
% heated with liquid fuel	0.4	4.8	+4.4
% heated with other fuels	2.3	2.0	-0.3
Number with central heat	21,803	36,415	+14,612
% with central heat	20.9	29.4	+8.5
% heated with coal	92.8	49.2	-43.6
% heated with gas	4.0	47.9	+43.9
% heated with liquid fuel	0.4	1.6	+1.2
% heated with other fuels	2.8	1.3	-1.5
Number with noncentral heat	82,632	87,275	+4,643
% with noncentral heat	79.1	70.5	-8.6
% heated with coal	95.8	56.7	-39.1
% heated with gas	1.6	35.1	+33.5
% heated with liquid fuel	0.4	6.2	+5.8
% heated with other fuels	2.2	2.0	-0.2
COOKING USE			
Number of dwellings reporting cooking equipment	105,272	123,510	+18,238
% cooking with coal	50.8	29.7	-21.1
% cooking with gas	38.6	51.1	+12.5
% cooking with electricity	4.1	13.9	+9.8
% cooking with liquid fuel	2.8	3.0	+0.2
% cooking with other fuels	3.7	2.3	-1.4

Coal has made its greatest gain in the electric utility market. The closest steam-electric plants are the three at Gorgas, 25 miles west of Birmingham. Two additional new units are being built there.

Railroad conversion to diesel engines is practically completed in the Birmingham area.

The over-all trend, then, seems to be a decline in the use of coal for domestic and railroad fuel purposes, a fluctuating but general increase in the industrial market, and an increase in the electric utility market.

It should be noted that the burning of coal is less efficient in domestic furnaces and is burned more completely in steam-electric plants. Therefore, pollution of the atmosphere by black smoke due to the burning of coal has been declining. However, increased consumption will mean increased amounts of other emissions such as the oxides of sulfur and nitrogen (Table 12).

Table 12. EMISSION OF POLLUTANTS FROM PUBLIC CONSUMPTION OF FUEL

Component	Emissions (lbs/ton of fuel burned)				
	Heating fuels			Motor vehicle fuels	
	Natural gas[20]	Fuel oil[20]	Coal[21]	Gasoline[20]	Diesel fuel[38]
Aldehydes	2	2.4	2	6	5
Oxides of nitrogen	14	26	8	8	49
Oxides of sulfur	0.3	60	40	5.7	10
Organics	3	10	20	70	--
Acids (as CH_3COOH)	2.5	30	30	0.6	10
Solids	---	0.5	200	0.1	34
Ammonia	---	---	---	0.7	--

Gas

The trend toward the use of natural gas for domestic and industrial purposes has been dramatic (Figure 10 and Table 11). It is to be noted that

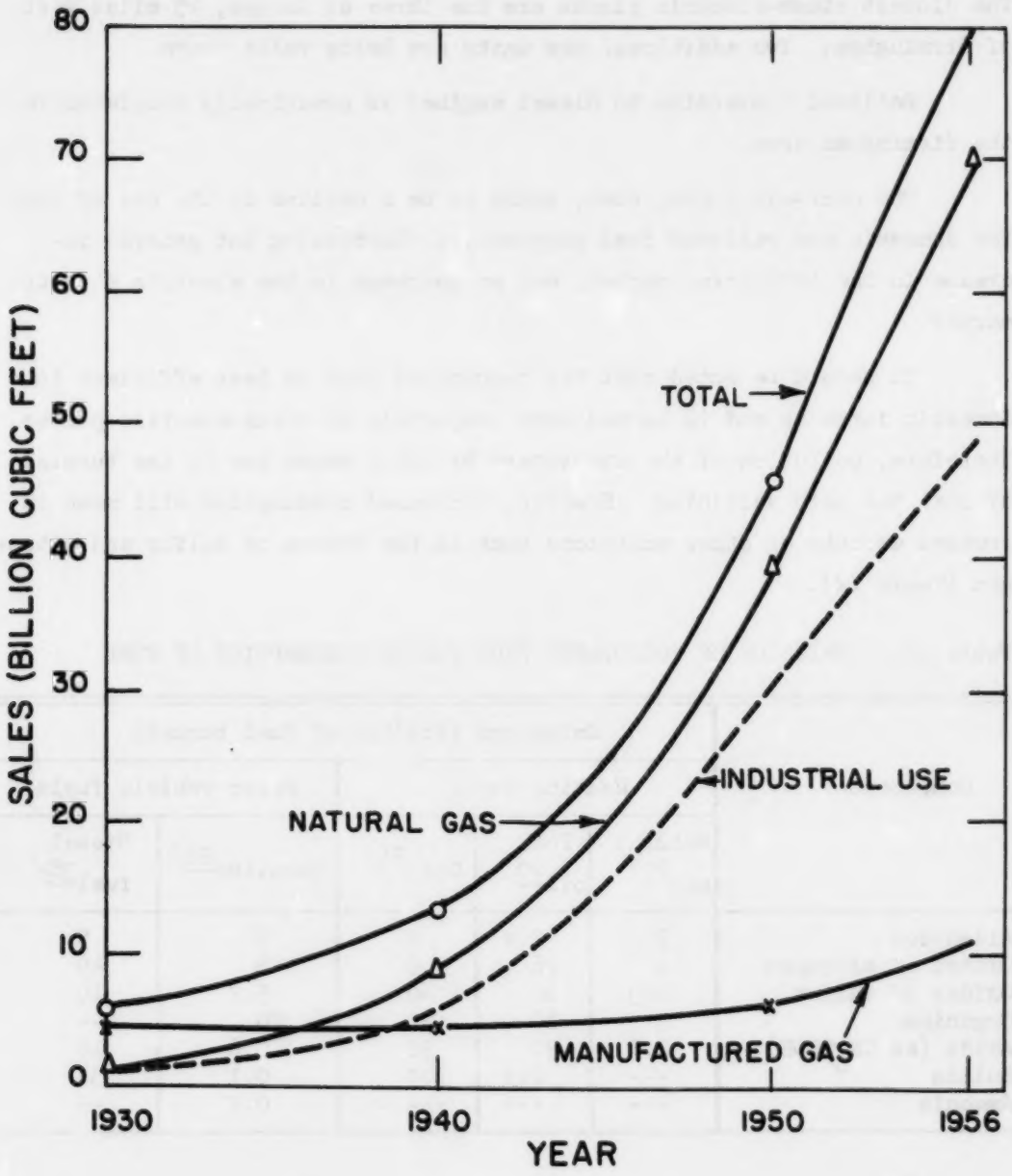

FIGURE 10. TOTAL GAS SALES - JEFFERSON COUNTY, ALABAMA[23]

the upward swing has been rather recent and that it has been due to increased industrial use as well as to the conversion of domestic coal furnaces to gas. During cold weather, industrial users may be on an interruptable service basis and therefore may use other stand-by fuels in the winter months.

Although gas is the cleanest burning of the popular present-day fuels, it does produce some air pollutants during combustion (Table 12).

Petroleum

Petroleum is used for heat and power, lubrication, and as a raw material for thousands of products from nylon to asphalt paving. As a source of atmospheric pollution, we are primarily interested in its use as a fuel and as a raw material for certain products. As a fuel oil, it is used for space heating in homes, office buildings, or industries. It is also used for power in steam boilers and diesel engines. It is estimated[15] that approximately 16-1/2 million gallons of fuel oil were burned in homes, boilers, diesel-powered motor vehicles, and diesel locomotives in Jefferson County in 1950. The figure was about 18 million gallons in 1956. These combustion processes result in the emission of significant amounts of oxides of nitrogen and sulfur, organic acids, and organics (Table 12). Kerosene is used principally as a range oil, but only a few per cent of the dwellings in Jefferson County continue to use this fuel for cooking (Table 11). It is estimated that the consumption of kerosene for Jefferson County in 1950 and 1956 were about 5,000 and 8,000 gallons respectively.[22]

Table 13. REGISTRATIONS OF MOTOR VEHICLES, JEFFERSON COUNTY, ALABAMA[24]

Year	Automobile tags	Truck tags	Bus tags	Other* tags	Total
1940	64,162	10,082	173	1,230	75,647
1950	104,483	22,417	631	4,161	131,692
1956	143,311	21,610	339	4,930	170,190

* Other includes motorcycles, ambulances, trailers, and all other types of vehicles.

Large volumes of gasoline are burned each year and produce atmospheric pollutants in significant quantities (Table 12). Motor vehicle registrations have been increasing rapidly in recent years (Table 13). Coupled with this is a corresponding increase in the consumption of motor vehicle fuel (Table 14). The seasonal variation of motor vehicle fuel consumption is very slight as compared to the variation in space-heating fuel consumption[9] (Table 15).

Table 14. GASOLINE AND DIESEL FUEL SALES, JEFFERSON COUNTY[24]

Year	Sales (gallons)
1952	118,062,000
1953	124,639,000
1954	131,852,000
1955	147,548,000
1956	161,512,000

Table 15. SEASONAL VARIATION IN MOTOR AND SPACE HEATING FUEL CONSUMPTION, BIRMINGHAM

Month	% Motor fuel consumed[24]	% Heating fuel consumed*
January	8.0	22.2
February	7.9	18.1
March	8.3	13.5
April	8.3	4.6
May	8.4	1.1
June	8.4	0.0
July	8.2	0.0
August	8.5	0.0
September	8.2	0.5
October	8.5	4.4
November	8.2	14.2
December	9.1	21.4
Total	100.0	100.0

* Based on number of degree days.

At present, there are no generally accepted devices for the control of emissions from automobile and diesel engines. However, much research is being conducted to devise satisfactory controls or techniques such as the use of afterburners in the exhaust system.

There are 119 airline flights into and out of Birmingham Municipal Airport each day. The combustion of fuel with the resultant emissions is probably relatively small but is a contribution, nevertheless, to the total pollution of the area.

With this information in hand, it appears that the use of petroleum in the form of heating fuels will continue to increase with the population growth of the county and the expansion of industry. The small amount of distillate fuel oil used for

cooking will decrease even further and the use of diesel fuel for locomotives will probably level off now that the conversion to diesels is essentially complete. The consumption of motor vehicle and aviation fuel can be expected to rise rapidly. Therefore, the total use of petroleum fuels will probably continue to advance at a significant rate. It would seem that the use of petroleum by-products having air pollution significance, such as asphalt paving, will also mount. As a consequence, pollution emissions resulting from the use of petroleum should continue to increase.

INDUSTRIAL ACTIVITIES

Steel is the major industry in the Birmingham area, and as such it contributes much to the pollution of the atmosphere (Figure 11). During the 1956 steel strike, a special air sampling study was conducted during July and August for the purpose of investigating the effect of this industry on suspended particulate pollution levels.[27] Sampling was conducted at three stations in the Birmingham area, both during and after the strike (Figure 12). One site was located near central Birmingham (University Medical Center), one in Bessemer (Bessemer Health Center), and one in the extreme western section of Birmingham near some of the larger steel mills (Western Health Center). As would be anticipated, the concentrations of suspended particulate material increased significantly when the industry resumed activity. It is estimated that industry in this area uses about seven million tons of coal per year, of which six million tons are used for making coke. Information which would permit a reliable estimate of the oil consumed as fuel by industry was not readily available.

When no control equipment is utilized, the emissions from open hearth furnaces average about 11 pounds of dust and fume for each ton of steel produced;[25] from electric-arc steel melting furnaces a mean quantity of 10.6 pounds of fume is generated per ton of metal melted;[26] and from gray iron foundries particulate emissions range from about 13 to 35

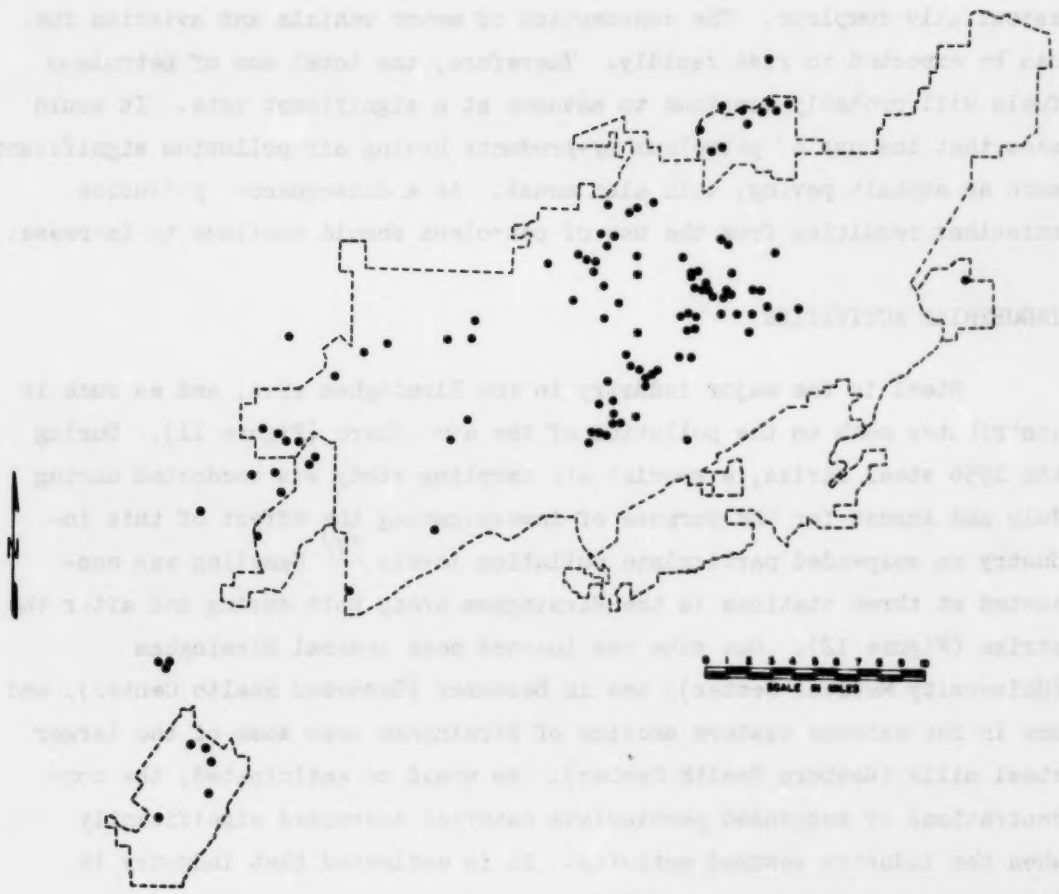

FIGURE 11. DISTRIBUTION OF SUSPECTED MAJOR POLLUTION SOURCES, BIRMINGHAM AREA

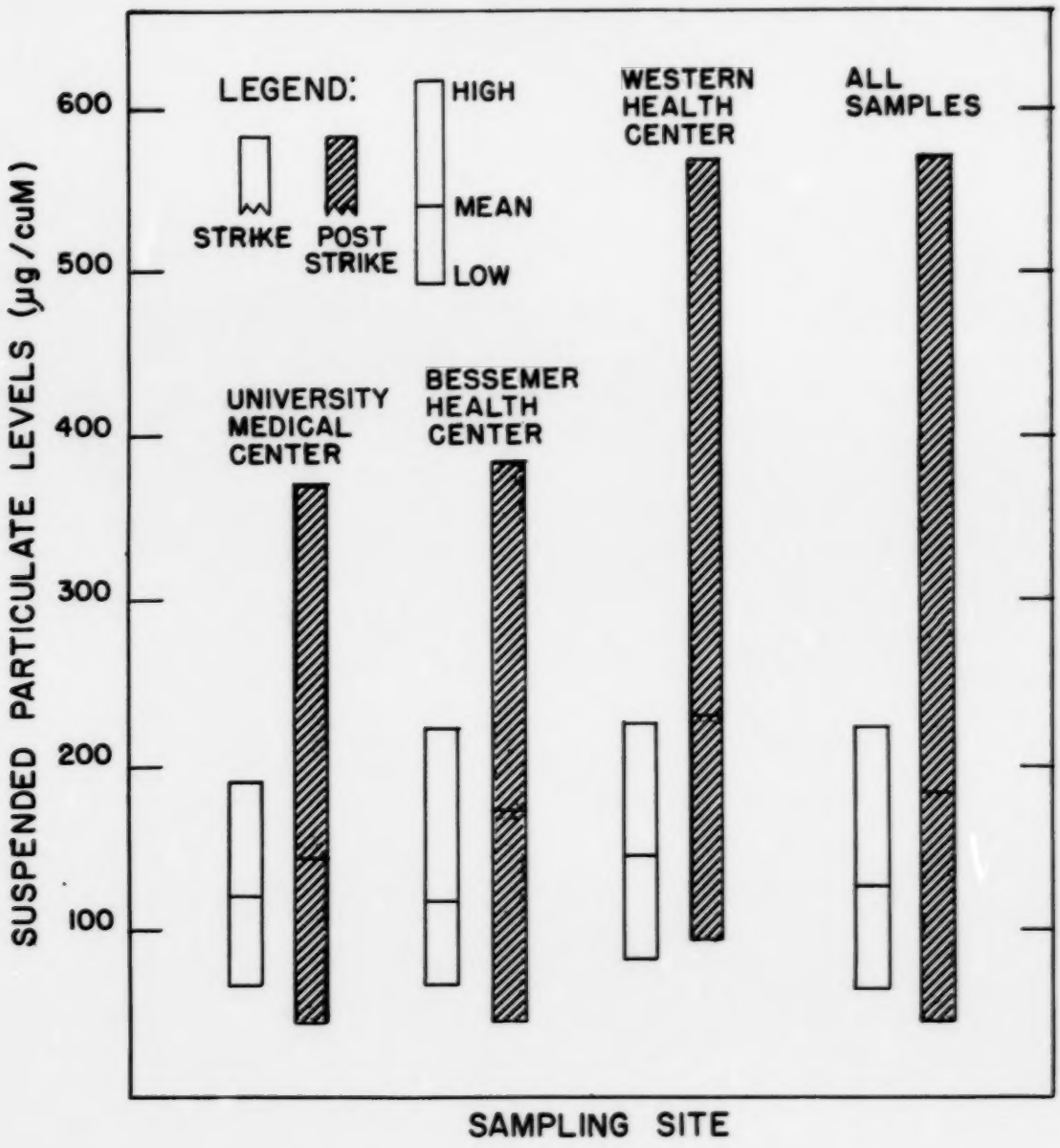

FIGURE 12. SUSPENDED PARTICULATE LEVELS, BIRMINGHAM, ALABAMA, SHOWING MEANS AND EXTREMES DURING AND AFTER 1956 STEEL STRIKE[27]

Table 16. TYPICAL INDUSTRIAL SOURCES AND POLLUTANTS ASSOCIATED WITH THEM

Industry	Pollutants	Industry	Pollutants
Blast furnace	Iron ore fines Coke and limestone dust Hydrogen sulfide gas (H_2S) Carbon monoxide gas (CO)	Plastic plants	Organic odors Aldehydes Amines etc.
Open hearth	Oxides of iron and manganese Lime and slag particles Combustion gases Oxides of sulfur	Cement and lime plants	Fly ash and smoke Combustion gases Sulfur dioxide (SO_2) Rock, cement, or lime dust
Electric furnaces	(similar to open hearth)	Agricultural chemicals	Dust and odors Ammonia NH_3
Bessemer converter	(similar to open hearth -- much greater volume per unit time)	Acid plants	Acid mists and gases
		Foundries	Metal oxide fumes and cupola dust Combustion smoke and gases
Coke ovens	Coke dust Volatile coal tars & smoke Hydrogen sulfide Ammonia Phenols	Aluminum reduction plants	Fluorides
Plating, anodizing and surface-conditioning industries	Chromic & sulfuric acid mists Caustic mists Hydrogen cyanide Hydrogen chloride Nitrogen oxides	Smelters	Metal oxide fume (flue dust) Sulfur dioxide (SO_2) Combustion gases
		Paint & surface-coating plants	Paint mist Odors Nuisance-creating particulates

Table 17. TYPICAL EXHAUST EMISSIONS FROM VARIOUS INDUSTRIES[21]

Exhaust emission	Emission rates			
	Nonferrous foundries Tons/plant producing 50 tons of castings/day.	Gray iron foundries Tons/plant producing 200 tons of castings/day.	Chemical & allied products Tons/plant consuming 10^9 Btu/day.	Stone, clay, & glass mfg. Tons/cement plant producing 4,830 bbl/day.
Sulfur dioxide	0.040	0.46	0.914	3.36
Sulfur trioxide	0.002	0.023	0.147	0.17
Hydrogen sulfide	0.002	0.023	0.024	0.17
Nitrogen oxide, as NO_2	0.014	0.092	0.200	1.18
Hydrogen cyanide	0.002	0.023	0.022	0.17
Ammonia	0.002	0.023	0.078	0.17
Hydrogen chloride	0.002	0.023	0.089	0.17
Formaldehyde	0.002	0.023	0.046	0.17
Organics	0.010	0.23	0.993	0.84
Acids as CH_3COOH	0.030	0.34	0.518	2.52
Solids	1.0	11.5	1.300	90.97
Fluoride as F	----	0.005	----	----

REFUSE DISPOSAL

All garbage and most other refuse in the Greater Birmingham area are collected by municipal forces and disposed of in municipal incinerators, open dumps, and sanitary landfills. However, there is some back-yard open burning of refuse in a variety of wire baskets, oil drums, ashpits, back-yard incinerators, etc.

Except for the true sanitary landfill, all of these disposal methods contribute to the general air pollution of the area. The back-yard methods create nuisance problems in the immediate vicinity of the fires due to smoke, odors, and blowing ashes (Table 18).

The amount of household rubbish varies considerably during the year, there being about twice as much in the summer as in the winter. This is due in part to the inclusion of yard trimmings, brush, trimmings from fresh vegetables and fruits, etc. Back-yard burning of such rubbish is much more extensive during the summer and fall months.

Birmingham is seeking a new $3-million incinerator to replace the existing 30-year-old model presently in use in the downtown area. Each day the eight furnaces burn approximately 150 tons (15 per cent) of Birmingham's municipally-collected refuse plus about 30 tons of brush. In addition, the city maintains three sanitary landfills, uses about 400 portable refuse bins at strategic points, and allows salvage companies to collect waste paper from commercial establishments. Residential streets are swept every two weeks, main thoroughfares every week, and the downtown streets are flushed and hand-swept every night. Keeping streets clean not only improves the appearance of a city but also removes the particulate matter which might be blown about by gusts of wind.

Bessemer utilizes an incinerator, Fairfield has a burning dump, Homewood utilizes a sanitary landfill, and Mountain Brook is converting its dump to a sanitary landfill.

Table 18. EMISSIONS FROM BURNING REFUSE IN BACK-YARD INCINERATORS[28]

Compontent	Emissions (lbs/ton of refuse burned)
Methanol	9 - 23
Ethylene	8 - 61
Acetone	> 8
Methane	23 - 150
Acetylene	< 4 - 73
α-Olefins (as propylene)	< 6
Carbonyl sulfide	> 3
Benzene	> 3
Acids (as acetic acid)	> 4
Phenols (as phenol)	> 8
Aldehydes (as formaldehyde)	5 - 64
Ammonia (may include some from low molecular weight amines)	0.9 - 1
Oxides of nitrogen (as NO_2)	< 0.1
Acetaldehyde	present
Guaiacol	present
Carbon monoxide	197 - 990
Esters	present

INDICATIONS OF PRESENT POLLUTION LEVELS

The most readily recognized evidence of present pollution levels in Jones Valley is reduced visibility on many days of the year. The major effect of such reduced visibility, other than aesthetic, is the interruption of airline schedules.

It was observed that the exterior walls of downtown Birmingham buildings were darkened and that there was heavy dirt fall on window sills and Venetian blinds.

Samples of the suspended particulate material in the air over Birmingham are collected biweekly as part of the National Air Sampling Network of the U. S. Public Health Service, and additional frequent samples are collected in connection with a special national cancer study. The weighted average concentration of suspended particulate material in the air over 54 Network cities of the United States having a population of 100,000 to 400,000 for the period 1953-1957 was 140 micrograms per cubic meter. Birmingham joined the Network in 1957, and the average of the 25 samples collected during the year was 129 micrograms per cubic meter (Tables 19 and 20, Figure 13).

The sampling conducted during the 1956 steel strike demonstrated that this industry makes a significant contribution to suspended particulate levels in the atmosphere over Birmingham (Figure 12). The average weight of suspended particulates for the three sampling sites combined increased from 128 micrograms per cubic meter during the strike to 184 micrograms per cubic meter after the mills resumed operations.

Table 19. SUSPENDED PARTICULATE CONCENTRATION* IN THE ATMOSPHERE OVER BIRMINGHAM, ALABAMA, CUMULATIVE DISTRIBUTION, 1957 (see Figure 13)

Min.	Mean	Max.	Percent of samples with concentration equal or less than the value shown below								
			10%	20%	30%	40%	50%	60%	70%	80%	90%
50	129	285	65	81	89	100	117	145	161	171	201

* micrograms per cubic meter of air

Table 20. SUSPENDED PARTICULATE CONCENTRATION* OVER BIRMINGHAM, ALABAMA, BY MONTH, 1957

Item	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
No. samples	2	3	1	2	3	2	2	1	2	3	2	2
Minimum	171	195	78	177	242	88	166	166	197	285	118	154
Mean	165	130	78	113	124	72	131	166	139	170	116	112
Maximum	159	87	78	50	54	56	97	166	82	101	115	99

* micrograms per cubic meter of air.

NOTE: The above results are derived from the twenty-five air samples taken during 1957 as a part of the National Air Sampling Network.

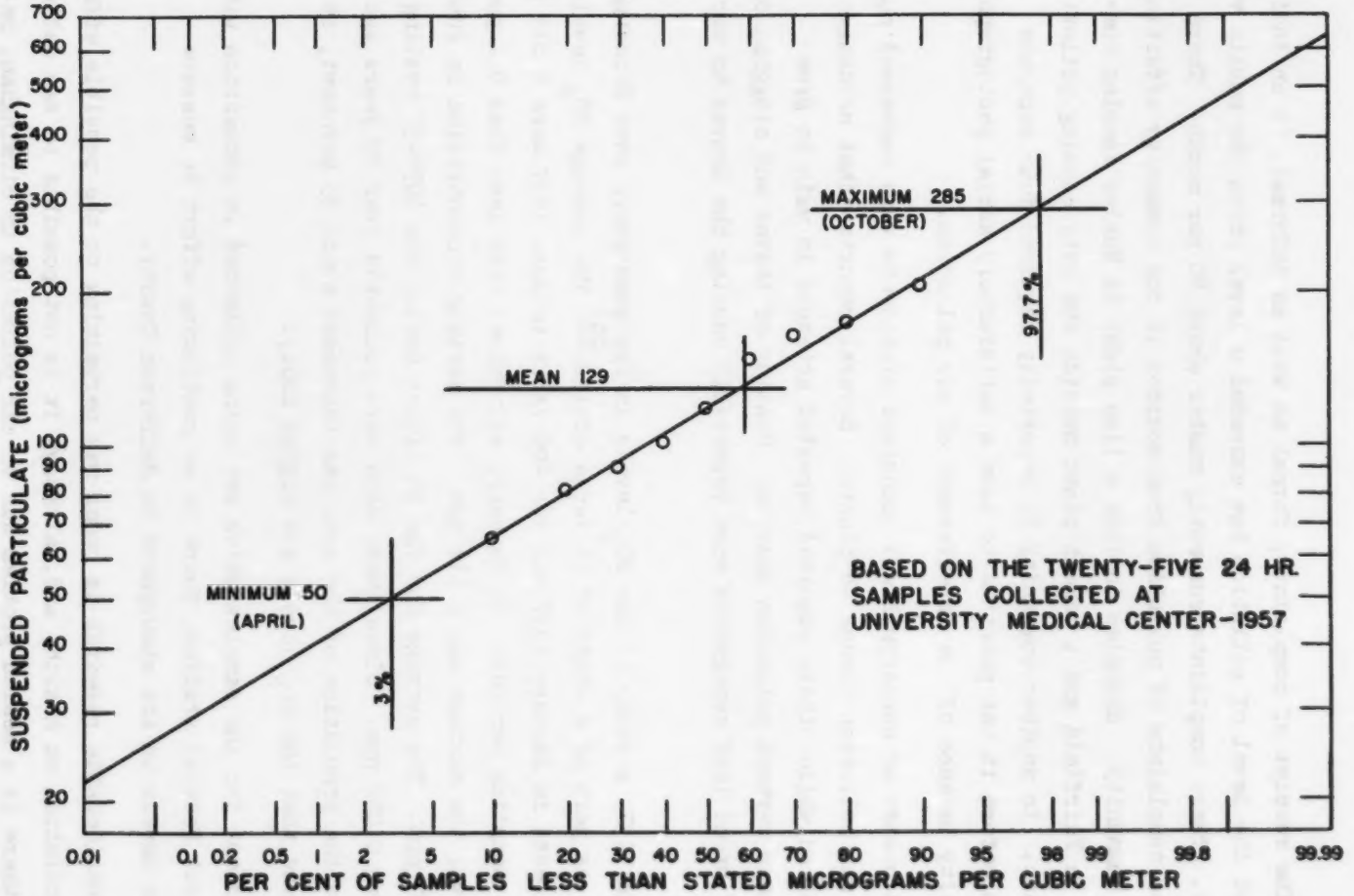

FIGURE 13. SUSPENDED PARTICULATE CONCENTRATION IN THE ATMOSPHERE OVER BIRMINGHAM, ALABAMA, CUMULATIVE DISTRIBUTION, 1957 (see Table 14).

The receipt of complaints, formal as well as informal, is an indication that the level of pollution has exceeded a level which the public will tolerate. These complaints currently number about 80 per month. There have been complaints of pollution from sources in one community affecting another community. Examples include a lime plant in Ensley causing complaints in Fairfield and a cement plant outside the city causing pollution in Tarrant. In another community it reportedly required four separate attempts before it was possible to take a satisfactory aerial photograph of the city because of the interference of air pollution.

A number of nurserymen and landscape architects were canvassed concerning air pollution damage to plants. Several reported that no damage was observed while others reported repeated attempts in vain to grow plants near certain pollution sources. Coating of leaves and clogging of pores of broad leaf evergreens were reportedly causing the leaves to curl and die.

In 1937, a study of the SO_2 levels in the atmosphere over Birmingham was made as part of a study of 24 large cities.[29] The average SO_2 levels for 440 tests in January 1937 and for 499 tests in June 1937 were 0.017 ppm for both sampling periods. In January, all values were less than 0.1 ppm except two; the maximum was 0.114 ppm. The maximum concentration in June was 0.087 ppm. The average for the 24 cities during the 1936-37 heating season was 0.052 ppm. Since these data were collected over 20 years ago and since the population of the area has increased about 35 per cent, it is presumed that the SO_2 levels are higher today.

Except for the samples which are being collected in connection with the several Federal studies, there is no continuing effort to measure pollution levels in the atmosphere in Jefferson County.

Considerable research is under way pertaining to the possible effects of air pollution on health, and, although it is not possible to say definitely that there is a health problem due to air pollution in Birmingham, research results may later prove this to be a fact.

PRESENT CONTROL ACTIVITY

AIR POLLUTION

The only specific air pollution control legislation is Birmingham Ordinance No. 523F, "An Ordinance to Provide for Abatement of Smoke, Soot, Fumes and Gases" which was passed by the City Commission in October 1945 (Appendix B).

The ordinance, among other things, prohibits dense smoke, requires approval of equipment, requires permits and establishes fees, establishes a Smoke Abatement Board, prohibits open fires, and provides for administration and enforcement by a Chief Smoke Abatement Inspector and his deputies and assistants.

The City Code requires the disposal of garbage or trash in garbage and trash cans and prohibits the burning of garbage anywhere except upon city property.

Fairfield has an ordinance controlling outdoor burning practices. It is a fire prevention measure enforced by the fire chief.

Tarrant has an ordinance to control burning of trash which is to be enforced by the police chief.

The activities of the Chief Smoke Abatement Inspector for Birmingham consist, for the most part, of handling nuisance complaints about individual smoke sources and obtaining correction of violations.

The regulations of the Jefferson County Board of Health include one which prohibits the burning of used batteries or battery cases. These

are sometimes used as space heater fuel and result in the emission of dangerous amounts of lead fumes.

BUILDING CODES

All of the communities in the Greater Birmingham area utilize either the Southern Standard Building Code or the Birmingham Building Code. These do not have provisions directed specifically toward the control of air pollution or the efficient burning of fuel. All of the heating system provisions pertain to fire protection and affect smoke emission very little.

PLANNING AND ZONING

In 1943, the Birmingham City Commission adopted an ordinance creating a Planning Board to serve in an advisory capacity to the City Commission. In 1947, the State Legislature authorized cities the size of Birmingham to exercise planning functions five miles beyond their corporation boundaries, but Birmingham did not act in time to take advantage of it. However, there is a bill before the State Legislature which proposes to open the matter and which, in addition, would authorize such cities to control zoning three miles beyond the city limits.

Zoning is a separate activity in Birmingham's government.[30] The Zoning Board operates under a zoning ordinance and map dated 1926 which have been amended by "spot zoning" many times since. The ordinance contains no specific use provisions aimed at controlling air pollution.

In 1955, an ordinance was adopted creating a planning commission, having full official status as an agency of the city, and combining the administrative and clerical functions of both the Planning Commission and the Zoning Board in one department of the city government. In 1957, these functions were transferred to the Department of Public Improvements.[31] This Commission is not a metropolitan planning commission, although recent attempts have been made to obtain the necessary extraterritorial rights to qualify it as such.[32]

The City of Bessemer has a zoning and planning board and a zoning ordinance dated June, 1954. The ordinance prohibits certain activities in the residential and business districts because of their being". . . injurious because of offensive fumes, odors, dust, or other objectionable features. . .". It provides for the ". . . abatement of noise, smoke, gas, vibration, fumes, dust and fire and explosion or nuisance . . ." on the basis of their being". . . a hazard to health, comfort, and convenience."[33]

The Bessemer ordinance is enforced by the Building Inspector or other authorized officer of the city and requires building permits and plan approvals. The city has a master plan and land use maps are on hand.[34]

Fairfield has a planning and zoning board but no staff. It has a zoning plan under consideration which is being developed through contract with a State agency. There is a "Long-Range Land Use Plan" dated June, 1957, which shows all industrial development to the west and northwest of the city.[35] At present, first-class residential property is adjacent to big steel mills.

Mountain Brook has a metropolitan planning commission and a zoning board which meet only when circumstances warrant. Land use is very near to that prescribed by the 1945 zoning ordinance as revised. There are subdivision regulations and a master plan is being developed. There is no industry in Mountain Brook.

Homewood has a planning commission. Part of the area is zoned for heavy industry, but there is no land used for that purpose as yet.

Tarrant has a planning and zoning commission which plans to re-zone the city very shortly.

Jefferson County has a board of zoning adjustment and a planning and zoning commission which are advisory to the County Commissioners. The entire unincorporated area of the County has been zoned, subdivision regulations have been established, and a standard set of 15 zoning classifications (districts) have been adopted.[36] The C-4 district provides a place

for commercial establishments creating obnoxious odors, fumes, and gases. The I-1 district prohibits those industries which cause air pollution. I-4 districts are industrial parks which prohibit residential and commercial uses and objectionable air pollution.

The Jefferson County Board of Health has the authority to adopt rules and regulations under Title 22 of the State Code. The Board, like most county boards of health, cannot enact ordinances, nor can the County Board of Commissioners enact laws. The rules and regulations would permit exercise of control over certain air pollution situations; however, it would be desirable to have state enabling legislation enacted which would permit the County to adopt air pollution control legislation.

CONCLUSIONS

There is a significant degree of air pollution in the Birmingham Metropolitan Area as evidenced by such subjective observations as reduced visibility, blackening of buildings and other exposed surfaces, deposits of dirt on window sills, and damage to vegetation near particular sources of pollution. There are some objective data, in the form of air analyses, to substantiate these observations.

This pollution, which is the result of industrial and commercial activity, home heating, and the burning of waste materials, has been recognized by Birmingham officials as being undesirable. This recognition is evidenced by the enactment of a smoke control ordinance, the hiring of a pollution control officer, and the newspaper coverage accorded control efforts and activities.

The present ordinance is considered inadequate to cope with the problem. Some of the principal weaknesses are: no pollution emissions except dense smoke are prohibited; no equipment of interest in air pollution control is regulated except that associated with fuel burning; the limitation on emission of dense smoke (Ringelmann No. 3) is too liberal for present-day practice; certain fuel-burning units are unnecessarily exempted from provisions of the ordinance; and use of high volatile coal is permitted in some equipment wherein it is extremely difficult to burn it smokelessley. Present control activity is meager; only one man is employed in carrying out the control program for Birmingham and none in the remainder of the affected area. A study of control programs in the United States[37] showed that areas with approximately the same population as Birmingham employ an average of three to four full-time professional or technical persons.

The nature and quantity of emissions in Jones Valley are determined by the nature and size of the sources and by the emission controls that are employed. The pollution intensity and area affected, however, are strongly influenced by the topography and climatology. They are not influenced by political boundaries. Therefore, in order to be most effective, the scope of the control program within Jefferson County should preferably be county-wide.

Sufficient information is available to indicate the need for a control activity, but there are very little real data upon which specific control actions can be determined or based. Meteorological data are needed relative to air movement at various points in the valley and at various times of the day, and measurements should be made which would denote the frequency, height, intensity, and duration of temperature inversions. Considerably more exact and detailed information is needed concerning the nature and magnitude of pollution emissions throughout the area to guide control efforts and provide a basis for detailed regulations. Except for the weekly high-volume air samples being collected in cooperation with the Public Health Service National Air Sampling Network program, no measurements of air quality are available to the official agencies. The present control officer does not have sampling equipment or laboratory facilities for making technical measurements. The County Health Department has good laboratory facilities which could be used to meet some needs in this regard.

An adequate air pollution control program requires the services of a trained and experienced engineer as control officer and he needs a staff to carry out inspection, sampling, chemical analyses, and routine office activities. If the program for Jefferson County is administered by a single official agency, there would, of course, be economy in the number of personnel required and in capital equipment expenditures. Jefferson County Health Department appears to be the only existing agency which could conduct such a program, given suitable authority and resources.

Control of air pollution costs money. But the uncontrolled pollution costs even more money in damage to vegetation, corrosion of materials, cleaning expenses, and other effects detrimental to the general public welfare. An adequate program for the Greater Birmingham Area would cost approximately $75,000 per annum.

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APPENDIX A

JEFFERSON COUNTY
DEPARTMENT of HEALTH
1912 EIGHTH AVE. SOUTH • P.O. BOX 2591
BIRMINGHAM, ALABAMA

GEO. A. DENISON, M.D.
HEALTH OFFICER

June 21, 1957

Mr. Harry G. Hanson, Director
Robert A. Taft Sanitary Engineering Center
4676 Columbia Parkway
Cincinnati 26, Ohio

Dear Mr. Hanson:

Further reference is made to my letter of March 26, 1957, in which we requested an Air Pollution Survey of the City of Birmingham and its environs. It is my understanding that this survey will be conducted by Mr. Jean J. Schueneman and he expects to be in Birmingham the week beginning July 15, 1957.

It is requested that this survey include the extent and source of pollution, sources outside of the City of Birmingham, present activities on air pollution control, a suggested program and organization for an Air Pollution Control Program and the necessary legal procedures to instigate and organize an adequate Air Pollution Program within the City of Birmingham and its environs.

We certainly appreciate the fact that you are sending Mr. Schueneman for this survey and I can assure you we will give him all the assistance possible in aiding him in this work.

Yours very truly,

Geo. A. Denison, M.D.
Health Officer

GAD:GMTJr:md
cc-Mr. Howard W. Chapman
Regional Director
cc-Mr. Arthur N. Beck
Chief Sanitary Engineer
State of Alabama

CITY OF BIRMINGHAM ALABAMA

INDUSTRIAL CENTER OF THE SOUTH

DEPARTMENT OF
PUBLIC IMPROVEMENTS

J T WAGGONER
COMMISSIONER

JUNE 25, 1957

MR. HARRY G. HANSON, DIRECTOR
ROBERT A. TAFT SANITARY ENGINEERING CENTER
4676 COLUMBIA PARKWAY
CINCINNATI 26, OHIO

DEAR MR. HANSON:

I AM WRITING CONCERNING THE SURVEY TO BE CONDUCTED IN BIRMINGHAM, ALABAMA BY MR. JEAN J. SCHUENEMAN THE WEEK BEGINNING JULY 15.

THE SMOKE ABATEMENT DEPARTMENT OF OUR CITY IS UNDER MY SUPERVISION, AND, IF AT ALL POSSIBLE, I WOULD LIKE TO REQUEST THAT YOU INCLUDE AIR POLLUTION IN THE PROPOSED STUDY. I AM SURE SUCH INVESTIGATION AND REPORT WOULD BE OF REAL ASSISTANCE TO THE CITY OF BIRMINGHAM.

WE ARE BADLY UNDERSTAFFED IN OUR SMOKE ABATEMENT DEPARTMENT, DUE MAINLY TO OUR INABILITY TO FIND QUALIFIED PERSONNEL FOR THIS TYPE WORK. IN FACT WE HAVE ONLY ONE MAN EMPLOYED ON THIS PARTICULAR WORK NOW. HE IS DOING WHAT HE CAN TO ENFORCE OUR SMOKE ABATEMENT ORDINANCES.

WE WANT TO ENLARGE AND IMPROVE THIS DIVISION OF OUR CITY'S OPERATION AND FEEL, SHOULD THIS PROPOSED SURVEY INCLUDE AIR POLLUTION, IT WILL SERVE AS A BASIS FOR THE IMPROVEMENT WE HOPE TO MAKE.

WE WILL BE GRATEFUL FOR YOUR COOPERATION.

YOURS VERY TRULY,

J. T. Waggoner

J. T. WAGGONER

CC:
MR. HOWARD W. CHAPMAN
REGIONAL DIRECTOR
ATLANTA, GEORGIA

MR. ARTHUR N. BECK
CHIEF SANITARY ENGINEER
STATE OF ALABAMA

JTW:NN

MINUTES

Meeting in the Board Room of Jefferson County Health Department, 9:00 AM, Monday, July 15, 1957.

Subject: Air Pollution Survey of Birmingham and Vicinity by U. S. Public Health Service

Present:

Dr. G. A. Denison	- Jefferson County Health Officer
Mr. J. T. Waggoner	- Commissioner of Public Improvements, City of Birmingham
Mr. J. J. Schueneman	- U. S. Public Health Service
Mr. D. M. Keagy	- U. S. Public Health Service
Mr. Paul Pate	- Ass't Chief, Environmental Sanitation, Jefferson County Health Department
Mr. M. J. Sasser	- Chief, Inspection Services, City of Birmingham
Mr. Manasco	- Smoke Abatement Inspector - City of Birmingham
Dr. Pearce Johnson	- interested citizen
Mr. Lunow	- interested citizen
Miss Judy Holley	- Birmingham News

After an informal opening of the meeting, Mr. Schueneman reviewed the events which preceded and which led to the initiation of the survey which was to be conducted during this week of July 15, 1957.

Following this review, the objectives of the survey were reviewed further to past correspondence, and agreement was reached that the purposes of the study are to:

1. Review the existing and potential air pollution situation.
2. Review existing air pollution control activities.
3. Develop recommendations for legislation, organization, staff, facilities, and program relative to air pollution control activities.

The proposed plan of the field investigation to be followed by Messrs. Schueneman and Keagy was then outlined. It was revealed that considerable preliminary data had already been obtained per earlier suggestions in correspondence by Mr. Schueneman. Suggestions were offered by various members of the group relative to additional likely sources of information and promising points of contact.

Mr. Waggoner and Dr. Dennison concurred that the investigators should feel free to explore whatever and wherever they deem appropriate in order to obtain desired information or data relative to the survey.

Before the meeting adjourned it was agreed that another meeting would be held in the office of Mr. Waggoner at 2:00 PM on Friday, July 19, 1957.

G. A. DENISON, M.D.

J. T. WAGGONER

J. J. SCHUENEMAN DMK

APPENDIX B

B I R M I N G H A M S M O K E O R D I N A N C E

ORDINANCE NO. 523F

AN ORDINANCE TO PROVIDE FOR ABATEMENT OF SMOKE, SOOT, FUMES AND GASES

BE IT ORDAINED BY THE Commission of the City of Birmingham as Follows:

Section 1. DEFINITIONS. The following words, terms and phrases wherever used in this ordinance, including this section, shall have the meaning ascribed to them respectively in this section, unless the context plainly indicates otherwise or that a more restricted or extended meaning is intended.

"Boiler". A device or contrivance consisting in part of one or more water containers and of a furnace designed for production of heat for heating of water in such container or containers.

"Chart 3 Shade". The shade of Chart 3 of Ringelmann's Scale for grading the density of smoke as published by the Federal Bureau of Mines.

"Cold Locomotive". A locomotive from the furnace or firebox of which fire has been withdrawn or in the furnace or firebox of which fire has been extinguished.

"Fuel burning equipment". Stove, furnace, boiler, oven or vessel with chamber or space for combustion of fuel, whether with or without connected stack.

"High volatile fuel". Fuel with a volatile content of 20% or more on a dry basis.

"Low volatile fuel". Coke, oil, gas, charcoal or any other fuel with a volatile content of less than 20% on a dry basis.

"Mechanical fuel feeding equipment". A device for mechanically feeding fuel into the combustion chamber of a boiler, furnace or other apparatus used for the generation of heat.

"Specifications". Written or printed specifications, including any attached or incorporated plans.

"Stack". A smokestack, chimney, flue, duct or other conveyor for carriage into the atmosphere of products of combustion.

"Stoker". A device for mechanically feeding solid fuel into the combustion chamber of a boiler, furnace or other apparatus used for the generation of heat.

Section 2. DENSE SMOKE PROHIBITED. Emission into the atmosphere from fuel burning equipment of smoke of Chart 3 shade or darker is prohibited except as hereinafter in this section permitted.

During a period of 20 minutes after ignition of any new fire or commencement of cleanout of any furnace, there is permitted smoke of Chart 3 shade, and during such 20 minute period, smoke of darker shade for not exceeding an aggregate of six minutes, and, after such 20 minute period, smoke of Chart 3 shade or darker for not more than 3 minutes in any period of thirty consecutive minutes, provided that in no event is there permitted, but, on the other hand, there is prohibited, smoke of Chart 3 shade or darker for more than an aggregate of 20 minutes in any period of 60 consecutive minutes.

Section 3. PERSONS RESPONSIBLE FOR DENSE SMOKE. No person directly or indirectly in charge or control of any fuel burning equipment shall cause or allow emission therefrom into the atmosphere of smoke contrary to the provisions of Section 2 hereof.

Section 4. APPROVAL REQUIRED OF FUEL BURNING AND FUEL FEEDING EQUIPMENT AND STACKS.

(a) No fuel burning equipment or mechanical fuel feeding equipment shall be installed or erected in or as a part of any building or structure unless such fuel feeding or fuel burning equipment shall have been approved by the Chief Smoke Abatement Inspector; nor shall any fuel burning or fuel feeding equipment now or hereafter installed or erected to be reconstructed or structurally altered unless the specifications for such work shall have been approved by the Chief Smoke Abatement Inspector.

(b) No stack shall be erected or constructed or reconstructed or structurally altered in or as a part of any building or structure unless such stack or the specifications for such stack shall have been approved by the Chief Smoke Abatement Inspector.

Section 5. STANDARDS OF APPROVAL.

(a) Specifications shall be deemed approved if the same, or a duplicate thereof, be marked "approved" by the Chief Smoke Abatement Inspector. Any device, contrivance or instrument shall be deemed approved if approved in writing by the Chief Smoke Abatement Inspector or if in conformity with specifications approved by the Chief Smoke Abatement Inspector.

(b) If any fuel burning equipment or fuel feeding equipment shall be found by the Chief Smoke Abatement Inspector to be adapted for use without violating Section 2 hereof he shall approve the same and issue a certificate of approval; and he shall issue a certificate of approval of the specifications for the reconstruction or the structural alteration of any fuel burning equipment or fuel feeding equipment when the specifications therefor are found by him to be such that, upon completion of such work in conformity therewith, such fuel burning or fuel feeding equipment will be adapted for use without violating Section 2 hereof.

(c) If any stack or the plans and specifications for the erection, construction, reconstruction or for the structural alteration of any stack be found by the Chief Smoke Abatement Inspector to be such that upon erection or upon completion of such stack in conformity with such plans and specifications, the same will be adapted for use without violating Section 2 hereof, he shall approve the same and issue a certificate of approval.

(d) The Chief Smoke Abatement Inspector may issue and publish a general approval of such makes, models or kinds of fuel burning equipment or fuel feeding equipment as may be found by him to be adapted for use without violating Section 2 hereof; and it shall be his duty, upon request of any interested person, to make an adequate and reasonable inspection or test of any such equipment sold or offered for sale or intended for use in the City of Birmingham, for the purpose of giving or withholding such approval.

(e) It shall be unlawful for any person to represent that any fuel burning equipment or fuel feeding equipment has been approved by the Chief Smoke Abatement Inspector when the same has not been so approved.

(f) The approval of the Chief Smoke Abatement Inspector shall not excuse any person for causing or allowing the emission of Smoke contrary to the provision of Section 2 hereof.

Section 6. PERMITS REQUIRED.

(a) No mechanical fuel feeding equipment shall be installed in any building or structure, or reconstructed or structurally altered unless a permit for such installation, reconstruction or structural alteration shall have been issued by the Chief Smoke Abatement Inspector; and such permit shall be issued upon the payment of the permit fee required in Section 12 hereof and provided such mechanical fuel feeding equipment has been approved and a certificate of approval issued as provided in Section 5 hereof and provided that, considering the size, capacity, intended location and use of such mechanical fuel feeding equipment the same may reasonably be operated without violating Section 2 hereof.

(b) No stack shall be erected in or as a part of any building or structure, or reconstructed or structurally altered, unless a

permit for such erection, reconstruction or alteration shall have been issued by the Chief Smoke Abatement Inspector; and such permit shall be issued upon the payment of the permit fee required in Section 12 hereof and provided that, according to the plans and specifications for such stack, the same, when so completed in conformity therewith, will be adapted for use without violating Section 2 hereof.

(c) It shall be the duty of the Building Inspector and the Chief Smoke Abatement Inspector to collaborate to the end of avoiding conflicts between them in respect of any such installation or work; and any conflict between them in respect thereof shall be determined by the Commissioner of Public Improvements.

Section 7. SMOKE ABATEMENT BOARD.

There is hereby established a Smoke Abatement Board to be composed of five members appointed by the City Commission who shall serve at the pleasure of the City Commission. Two members of the board shall be competent combustion engineers, one member shall be a stoker engineer, one a coal operator and one a layman. They shall serve without compensation. They shall select their own chairman.

Section 8. DUTY AND AUTHORITY OF SMOKE ABATEMENT BOARD; APPEAL.

(a) It shall be the duty of the Smoke Abatement Board from time to time, to advise the Chief Smoke Abatement Inspector in respect of means and methods of abating excessive smoke in the City of Birmingham.

(b) Any person aggrieved by any action of the Chief Smoke Abatement Inspector in respect of the giving or withholding of approval as provided in Section 5 hereof or in respect of the granting or withholding of any permit as provided in Section 6 hereof, shall have a right to appeal to the Smoke Abatement Board. Such appeal shall be promptly heard and decided. The matter shall be set for hearing at a time and place to be fixed by the Board, of which reasonable notice shall be given to the appelant and to the Chief Smoke Abatement Inspector. The Board shall have the right to approve, modify or reverse the decision of the Smoke Abatement Inspector complained of and such decision shall be reduced to writing and a copy thereof delivered to the appelant and to the Chief Smoke Abatement Inspector; and the Chief Smoke Abatement Inspector shall promptly act in accordance with such decision. The said Board shall have no jurisdiction of conflicts between the Building Inspector and the Chief Smoke Abatement Inspector.

Section 9. HOT WATER HEATERS. The use of high volatile fuel in any hot water heater is prohibited unless such hot water heater be equipped with an approved smokeless furnace or approved stoker.

Section 10. OPEN FIRES.

(a) The burning of any paper, garbage, rubber tires, storage batteries, automobiles, scrap, waste, refuse or other combustible

material in an open receptacle or in an open place is prohibited.

(b) The use in an open receptacle, for the purpose of heating tar or asphalt, or any fuel other than coke or charcoal is prohibited, provided that oil in an approved oil burner may be used for such purpose.

Section 11. RAILROAD LOCOMOTIVES. Emission into the atmosphere from any railroad locomotive of smoke of Chart 3 shade or darker is prohibited except as hereinafter in this section permitted. During a period of 20 minutes after ignition of any fire in a cold locomotive or commencement of cleanout of any furnace or firebox in a warm locomotive there is permitted smoke of Chart 3 shade, and, during such 20 minute period, smoke of darker shade for not exceeding an aggregate of six minutes, and, after such 20 minute period, smoke of Chart 3 shade or darker for not exceeding one minute in any period of nine consecutive minutes.

All combustion equipment shall be suitable for burning the fuel used without violating the provisions of this ordinance.

Locomotives assigned temporarily to yard service in case of accident or other emergency, are excepted from the provisions of this section.

Any person operating suitable combustion equipment on a locomotive so as to emit smoke of prohibited shade or density, or who permits smoke of prohibited shade or density to be emitted from the smoke stack of any such locomotive not excepted from the provisions of this ordinance shall be deemed guilty of a misdemeanor and, upon conviction, shall be punished as provided in Section 17 of this ordinance.

Section 12. PERMIT FEES. Except as otherwise provided in the Building Code, the fee for the issurance of any permit under this ordinance for which application is made prior to the installation or the commencement of the work for which a permit is required hereunder, shall be $1.00, provided that the fee shall be $2.00 if application for such permit is made after such installation or after the commencement of such work.

Section 13. EXEMPTIONS. No provision of this ordinance, except the provisions of Section 1, 11, 14, 16 and 17, shall apply to railroad locomotives. No provision of this ordinance shall apply to any presently existing installation in any presently existing building or structure designed for the residential occupancy of two families or less and situated outside that certain area bounded on the south by the south line of Eighth Avenue, South, and on the west by the west line of 14th Street, and on the north by the north line of Eighth Avenue, North, and on the east by the east line of 26th Street as extended southward to the south line of Eighth Avenue, South, and outside the area occupied by buildings

fronting on portions of streets and avenues whose exterior lines form the aforesaid boundaries, which said area or areas may be referred to in the aggregate as the "critical smoke area."

Section 14. ENFORCEMENT. It shall be the duty of the Smoke Abatement Inspector to administer the provisions of this ordinance and together with his deputies and assistants, to enforce the same.

Section 15. VISITATION. The Chief Smoke Abatement Inspector, his deputies and assistants, shall have the right to visit the location of any fuel burning equipment or any fuel feeding equipment or any stack, during reasonable daylight hours for purposes of inspection; and interference by any person with the exercise of such right is prohibited.

Section 16. UMBRASCOPE PERMITTED. In order to aid the eye in grading shades of smoke, there may be employed an umbrascope comprised in part of a series of four gray glasses each of which is of sufficient capacity to cut off sixty per cent of the light from a flame with lighting power of 24 candles and all of which are equivalent to Chart 3 shade.

Section 17. PENALTY. Any person violating any provision of this ordinance shall upon conviction be punished within the limits of and as provided by Section 4 of the General Code of the City of Birmingham of 1944.